PROJECT MANUAL

▲

ALLEN & HOSHALL, PLLC
Michel Lebel, Architect
1661 INTERNATIONAL DR.
SUITE 100
MEMPHIS, TN 38120

Job No. 62565
DECEMBER 2016

SOUTHAVEN ELEMENTARY SCHOOL
CLASSROOM EXPANSION

DESOTO COUNTY, MISSISSIPPI

FOR

DESOTO COUNTY SCHOOLS

SECTION 00 0000

ADVERTISEMENT FOR BIDS

Notice is hereby given that sealed bids will be received for the project named below by the Desoto County School District, 5 East South Street, Hernando, Mississippi 38632, until Friday, January 20, 2017 at 2:00 p.m.

Location for Receipt of Bids:

Superintendent's Office
Desoto County School District
5 East South Street
Hernando, MS 38632

The work to be done consists generally of: The construction of a 4 classroom expansion of approximately 3,200 square feet. Addition has associated sitework which includes grading, drainage, utilities and other related work, as shown on the drawings and/or described in the specifications.

Plans and Specifications Entitled:

Southaven Elementary School Classroom Expansion
Desoto County Schools
Southaven, MS

May be inspected at the office of the Architect named below, or may be obtained from the Architect as set out below:

a. Qualified Prime (General) Contractors, Subcontractors, and Material Suppliers may obtain one digital copy of plans and specifications upon payment of $100.00, non-refundable. Copy of plans and specifications will be provided on compact disc (CD).

b. Qualified Prime (General) Contractors, Subcontractors and Material Suppliers may obtain additional copies of plans and specifications upon payment of $100.00 per copy, non-refundable.

c. Partial Sets will not be issued.

d. Copies of plans and specifications will be placed in plan rooms in major cities within the area, locally, and elsewhere as bona fide requests are received.

e. Make payment check payable to the Architect named below.

Proposals shall be submitted on proposal forms provided with the specifications and must be accompanied by Proposal Security in the form of Certified Check or acceptable Bid Bond in the amount equal to at least five percent (5%) of the Base Bid: such security to be forfeited as liquidated damages, not penalty, by any bidder who fails to carry out the terms of the proposal, execute contract and post Performance Bond in the form and amount within the time specified. The Bid Bond, if used, shall be payable to the Owner.

Bids on the Project must be received on or before the period scheduled for the project and no bid withdrawn after the scheduled closing time for the project for a period of forty-five (45) days.

All bids submitted in excess of $50,000.00 by a Prime or Subcontractor to do any erection, building, construction, repair, maintenance, or related work must comply with the Mississippi Contractors Act of 1985, by securing a Certificate of Responsibility from the State Board of Contractors.

PRE-BID CONFERENCE

A. A pre-bid conference has been scheduled on January 10, 2017 at 10:00 a.m. at the Owner's office listed below.

B. All general contract/major subcontract Bidders and Suppliers are urged to attend.

C. All Bidders are expected to have familiarized themselves with conditions relating to the work prior to the pre-bid conference.

The Owner reserves the right to reject any and all bids on any or all projects and to waive informalities.

OWNER:

Desoto County School District
5 East South Street
Hernando, MS 38632

ARCHITECT:

Allen & Hoshall, PLLC
1661 International Drive, Suite 100
Memphis, Tennessee 38120
PH: 901-820-0820
FX: 901-683-1001

DATES OF ADVERTISEMENT: DECEMBER 6, 2016

DECEMBER 13, 2016

END OF SECTION

PROJECT MANUAL

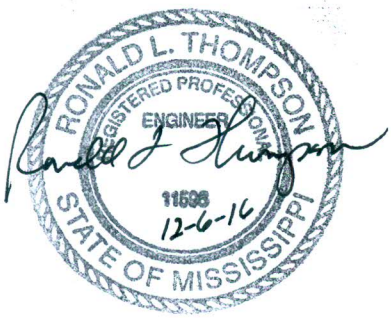
FOR

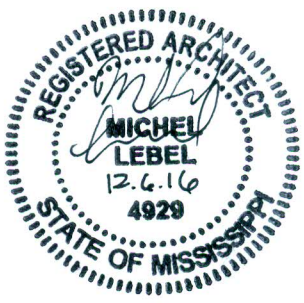
SOUTHAVEN ELEMENTARY SCHOOL
CLASSROOM EXPANSION

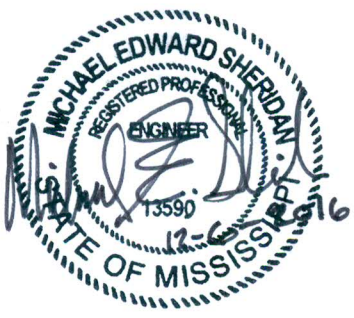
DESOTO COUNTY, MISSISSIPPI

FOR

DESOTO COUNTY SCHOOLS







ALLEN & HOSHALL, PLLC
Michel Lebel, Architect
1661 INTERNATIONAL DRIVE SUITE 100
MEMPHIS, TENNESSEE 38120

Job No. 62565

Date: DECEMBER 06, 2016

SECTION 00 0003
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DOCUMENT 00 0004

LIST OF DRAWINGS

The following is a list of Contract Drawings which this contract is to be based. These drawings are entitled SOUTHAVEN ELEMENTARY SCHOOL CLASSROOM EXPANSION, DESOTO COUNTY, MISSISSIPPI and dated DECEMBER 6, 2016 with revision dates (if any), as noted. They will be supplemented by additional shop and dimensional drawings of materials and equipment and other drawings where specified.

Drawing Number	Sub-Title	Revision Date
	COVER SHEET	
0.0	INDEX OF DRAWINGS	
	CIVIL	
C0.1	EXISTING CONDITIONS AND DEMOLITION PLAN	
C1.1	LAYOUT PLAN	
C2.1	GRADING AND DRAINAGE PLAN	
C3.1	EROSION CONTROL PLAN PHASE 1	
C3.2	EROSION CONTROL PLAN PHASE 2	
C3.3	EROSION CONTROL NOTES AND DETAILS	
C4.1	UTILITY PLAN	
C5.1	DETAILS	
	ARCHITECTURAL	
A0.1	ARCH. SYMBOLS, ABBREVIATIONS, BUILDING DATA, AND WALL TYPES	
AD1.1	DEMOLITION FLOOR PLAN AND DEMOLITION ROOF PLAN	
A1.1	FLOOR PLAN AND ROOF PLAN	
A3.1	REFLECTED CEILING PLAN	
A5.1	BUILDING ELEVATIONS AND SECTIONS	
A5.2	SECTION DETAILS	
A10.1	DOOR SCHEDULE, WINDOW TYPES, AND DETAILS	
A11.0	INTERIOR DETAILS	
A12.1	FINISH SCHEDULE & DETAILS	
	STRUCTURAL	
S1.0	STRUCTURAL GENERAL NOTES	
S2.0	FOUNDATION PLAN	
S3.1	SECTIONS & DETAILS	
S4.1	TYPICAL DETAILS	
	MECHANICAL	
M0.1	LEGEND, GENERAL NOTES - MECHANICAL	
M1.1	FLOOR PLAN - MECHANICAL	
M2.1	DETAILS - MECHANICAL	
	PLUMBING	
P1.1	FLOOR PLAN - PLUMBING	
P2.1	FLOOR PLAN - FIRE PROTECTION	
	ELECTRICAL	
E0.1	LEGEND, LIGHTING FIXTURE SCHEDULE AND DETAILS - ELECTRICAL	
E2.1	FLOOR PLAN - LIGHTING - ELECTRICAL	
E3.1	FLOOR PLAN - POWER, COMMUNICATIONS, AND FIRE ALARM - ELECTRICAL	

SECTION 00 2113

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Interpretations: Should a bidder find discrepancies in or omissions from the plans and specifications or be in doubt as to their written meaning, he should immediately notify the Architect in writing. The Architect will then send a written instruction or interpretation to all known holders of the documents if deemed appropriate by the Architect. Neither the Owner nor the Architect will be responsible for nor bound by any oral instructions or for a bidder's failure to make inquiry.

B. Addenda: Any addenda to the plans and/or specifications issued before or during the time of bidding will become a part of the Contract and receipt of same must be acknowledged by Bidder in his proposal.

C. "Or Equal" Substitutions: Refer to General Conditions 3.2.2 and Section 016200 - "Or Equal" Substitutions: Bidder is advised that some sections of the specifications may not allow for substitutions and that the requirements of the General Conditions and Section 016200 must be strictly complied with to obtain a substitution where substitution is allowed. Failure to strictly comply with the General Conditions and Section 016200 and any requirements in the technical specifications which do not conflict with and which are in addition to the General Conditions and Section 016200 may, in the Owner's sole discretion, result in the rejection of the request for "or equal" substitution.

1.2 BIDDING

A. Contract for Construction: Lump sum, single bid received from General Contractors and shall include General, Mechanical, Electrical, and Sitework as well as all other work shown on plans and specified herein.

B. Subcontractors and Suppliers: The Bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a Subcontract or Purchase Order under this Contract must be acceptable to the Owner.

1. The Owner may make such investigation as he deems necessary to determine the ability of the Bidder or subcontractors or suppliers to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein within the time required.
2. All subcontractors must have a current, valid, Contractor's License and/or Certificate of Responsibility where Bid exceeds $50,000.00.
3. Listing of Subcontractors and Suppliers:
   a. So that the Owner may be assured that only qualified and competent subcontractors and suppliers will be utilized on the project and to prevent "bid-shopping" and/or "bid-chopping", each Bidder shall identify within seven (7) days after Bid receipt date the name of the subcontractor and supplier used by the Bidder in his bid for each subcontractor and supplier whose bid or quote exceeds $50,000.00. Bidder's List shall be provided on the Listing Form provided with the Proposal Form. A Bidder's failure to indicate the name(s) of the

subcontractors and major suppliers included in his lump sum price within seven (7) days after Bid receipt may result in the rejection of the Bidder's bid as nonresponsive.

b. The successful Bidder shall use the subcontractor and supplier identified by him as being included in his lump sum price, provided however, the Bidder assumes the risk that the subcontractor or supplier listed within the seven (7) day period will be acceptable to the Owner and the Architect. The Bidder shall not substitute another subcontractor for the listed subcontractor or supplier unless agreed to in writing by the Owner.

c. If Bidder lists itself as a supplier for any of the classifications listed, then the Bidder will be required to furnish such product from its manufacturing inventory and to demonstrate to the Owner and Architect that it has satisfactory qualifications and prior experience manufacturing and furnishing such materials, equipment and/or products. If Bidder lists itself as a subcontractor for any of the classifications listed, then the Bidder will be required to perform the work with its own regularly employed personnel and to demonstrate to the Owner and Architect that it has satisfactory qualifications and prior experience performing such work with its own regularly employed personnel. The Owner reserves the right to reject any bid if the evidence submitted by Bidder fails to satisfy the Owner that the Bidder has satisfactory qualifications and prior experience performing such work and/or furnishing such materials, equipment and/or products.

1.3 CERTIFICATE OF RESPONSIBILITY

A. Each Bidder submitting a bid equal to or in excess of $50,000.00 on public projects and equal to or in excess of $100,000.00 on private projects must show on his bid and on the face of the envelope containing the bid, his Certificate of Responsibility Number, as required by Section 31-3-21 (latest revision) Mississippi Code. If the bid does not exceed $50,000.00 on public projects and $100,000.00 on private projects, a notation so stating must appear on the face of the envelope.

B. Each subcontractor shall also have a Certificate of Responsibility Number, as required by Section 31-3-21 (latest revision), Mississippi Code.

C. Evidence: No bid will be opened, considered or accepted unless the above information is given as specified. Sufficient evidence that said Certificate of Responsibility has been issued and is in effect at the time of receiving bids must be submitted if required by the Owner or the Architect. Likewise, it shall be the responsibility of the General Contractor to require a Certificate of Responsibility Number from any subcontractor that falls in the category of "B" above.

D. In accordance with Mississippi law, if the Bidder is a joint venture, either the joint venture or all of the Contractors which make up the joint venture must hold certificates of responsibility from the State Board of Contractors.

1.4 PRE-BID CONFERENCE

A. A pre-bid conference has been scheduled on TUESDAY, JANUARY 10, 2017, 10:00 A.M., at Main Office located at 5 East South Street, Hernando, Mississippi.

B. All general contract/major subcontract Bidders and Suppliers are urged to attend.

C. All Bidders are expected to have familiarized themselves with conditions relating to the Work prior to the pre-bid conference.

1.5 NON-RESIDENT CONTRACTOR

A. When a non-resident Contractor submits a bid for a Mississippi public project, he shall, prior to submission of the bid, attach thereto a copy of his resident State's current law pertaining to such State's treatment of non-resident Contractors as required by Section 31-3-21, Mississippi Code, (latest revisions).

1.6 BID BOND

A. Use AIA Document A310, Bid Bond, Latest Edition or equivalent for execution of Bid Bond.

1.7 BID SECURITY

A. Each bid, exceeding $5,000.00, must be accompanied by the Bidder's certified check or a bid bond, duly executed by the Bidder as principal and having surety thereon, a surety company approved by the Owner and signed by an agent resident in Mississippi, in the amount of five percent of the bid. All bid bonds must be accompanied by the appropriate Power of Attorney designating the Mississippi Resident Agent.

1.8 OPENING OF PROPOSALS

A. Refer to the Advertisement for Bids.

1.9 PREPARATION OF BID

A. Conditions of Work: Each Bidder must fully inform himself of the conditions relating to the construction of the project and employment of labor thereon. Failure to do so will not relieve a successful Bidder of his obligation to furnish all material and labor necessary to carry out the provisions of his Contract. The Contractor must employ methods or means to cause no interruptions of or interference with the work of any other Contractor.

B. Examination of Site: All Bidders, including the general contractor and subcontractors, will visit the site of the building, and inform themselves of all conditions. Failure to visit the site will in no way relieve the successful Bidder from his obligation to complete all work in accordance with the Contract Documents without additional cost to the Owner.

C. Staging and Access: All Bidders, including the general contractor and subcontractors, acknowledge that the construction premises are restricted and that access is affected by the location of the project, by the facilities surrounding the project and by other construction either presently being performed or proposed to be performed during the performance of this Contract. All Bidders, including the general contractor and subcontractors, further acknowledge that such limitations in space and accessibility have been taken into account in estimating their bids.

D. Laws and Regulations: The Bidder's attention is directed to the fact that all applicable state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project apply to the Contract. The successful Bidder shall be required to comply with all applicable laws, ordinances, rules and regulations at no additional cost to Owner whether such laws, ordinances, rules and/or regulations are enacted or adopted or become effective before or after bid opening.

E. Obligation of Bidder: At the time of opening of bids, Bidder will be presumed to have inspected the site and to have read and be thoroughly familiar with the plans and specifications, including all addenda.

F. Telegraphic and Facsimile Modifications: A Bidder may modify his bid by telegraphic or facsimile communication at any time, provided such communication is received by the Owner prior to the scheduled time for opening bids. Written confirmation must be received within two days from the bid opening time or no consideration will be given the telegraphic or facsimile modifications.

1.10 PROPOSALS

A. Form: Submit all proposals on forms provided and fill all applicable blank spaces without interlineation, alteration, or erasure and recapitulations of the work to be done. No oral, telegraphic, or telephonic proposals will be considered. Any addenda issued during the bidding must be noted on the Proposal Form.

B. Withdrawal: Any bid may be withdrawn prior to the time for opening of bids or authorized postponement thereof. Any bid received after the time and date specified will not be considered. All bids are irrevocable offers to contract at the price bid which may not be withdrawn until Forty-Five (45) days after bid opening.

C. Submittal: Submit bids in an opaque sealed envelope bearing on the outside, the name and Certificate of Responsibility number of the Bidder, his address, bid opening date, and time.

D. Any bid modification or qualification on the outside of the envelope will be considered only if accompanied by signature and title of person making the modification.

E. Mailing: If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed to:

Desoto County School District
5 East South Street
Hernando, MS 38632

F. Bidders are urged to deliver their bid to the Owner. Owner will not be responsible for misdelivery of mail or express deliveries.

1.11 Contract

A. Award of Contract: Award shall be made to the lowest and best Bidder, pursuant to Mississippi law and these Instructions to Bidders. The lowest bid shall be the base bid or combination of base bid and those alternates which produce a total within available funds. The Owner reserves the right to waive irregularities and to reject any and all bids.

B. Disqualification of Bidder: The Owner reserves the right to award to other than the low Bidder when, in the Owner's judgment, it is in his best interest to do so. For instance, a Bidder may be disqualified for such reasons as:

1. Bidder being in arrears on existing contracts.
2. Bidder being in litigation with the Owner or the institution/agency.
3. Bidder having defaulted on or failed to satisfactorily complete a previous contract with the Owner, including Bidder's failure to satisfactorily fulfill the warranty obligations of a previous contract with the Owner.

The above is not an inclusive list.

C. Security for Faithful Performance: When the bid exceeds $5,000.00 and simultaneously with his delivery of the executed Contract, the Contractor will furnish a payment and a performance bond in accordance with Section 31-5-51 et. seq. of the Mississippi Code (latest revision). The surety on such bonds will be a duly authorized surety company licensed to do business in the state of Mississippi which is acceptable to the Owner and which is listed on the United States' Treasury Department's list of acceptable sureties.

D. Time of Completion: By submission of its bid, Bidder agrees to commence work on or before a date specified in a written "Notice to Proceed" and to fully complete the project within the time stated in the Bid Proposal Form.

E. Substantial Completion: Substantial completion of the project shall be as defined by Section 9.8.1 of the General Conditions "...when the work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the work for its intended use."

F. Final Acceptance/Completion: Final acceptance/completion of the project as defined in the General Conditions 9.10.2.1 requires the submittal by Contractor of all closeout documents, all ownership and maintenance manuals required by the technical sections of the Contract, the Guarantee of Work required by the General Conditions 12.2.2.5 and 12.2.2.6 and the manufacturer's certifications. Bidder's attention is specifically directed to the General Conditions 9.8.4 for additional conditions precedent to final acceptance/completion of the project.

G. Liquidated Damages for Failure to Enter Into Contract: The successful Bidder, upon his failure or refusal to execute and deliver the Contract and required bonds within ten days after he has received notice of the acceptance of his bid, will forfeit to the Owner as liquidated damages the security deposited with his bid.

H. Liquidated Damages for Failure to Substantially Complete Project in Time Stipulated: Applicable when stipulated sum is shown in General Conditions 9.11.1.

1.12 BID DOCUMENTS

A. Plans and Specifications are available, unless noted otherwise on the Advertisement for Bid, at the office of Allen & Hoshall, PLLC, 1661 International Drive, Suite 100, Memphis, Tennessee 38120.

B. When required, as noted on Advertisement for Bid, deposits will be returned upon the Owner's receipt of the bid documents in good condition within ten (10) days after the opening of bids.

C. No partial sets of documents will be issued or accepted for return.

END OF SECTION

SECTION 00 3132

GEOTECHNICAL DATA

1.1 SUBSURFACE INVESTIGATION REPORT

A. A more detailed geotechnical report will be provided by addendum.

B. The report will identify properties of below grade conditions and offers recommendations for the design of foundations and other improvements, prepared primarily for the use of the Architect/Engineer.

C. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

D. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price/Sum accruing to the Owner.

END OF SECTION

SECTION 00 4100

BID PROPOSAL FORM

Project Identification: DESOTO COUNTY SCHOOL DISTRICT
SOUTHAVEN ELEMENTARY SCHOOL CLASSROOM EXPANSION
DESOTO COUNTY, MISSISSIPPI

This Bid is Submitted to: DESOTO COUNTY BOARD OF EDUCATION
5 EAST SOUTH STREET
HERNANDO, MISSISSIPPI 38632
ATTN: CORY USELTON

This Bid is Submitted from (Contractor):

_____

_____

_____

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with other terms and conditions of the Contract Documents.

2. Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for forty-five (45) days after the day of Bid opening. Bidder will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within fifteen days after the date of Owner's Notice of Award.

3. In submitting this Bid, Bidder represents, as more fully set forth in the Agreement, that:

   (1) Bidder has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

   (2) Bidder has studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions which are identified in the Supplementary Conditions and accepts the determination set forth in the General Conditions.

   (3) Bidder has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies (in addition to or to supplement those referred to in (c) above) which pertain to the subsurface or physical conditions at the site or otherwise may affect the cost, progress, performance or furnishing of the Work as Bidder considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents.

   (4) Bidder has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities. No additional examinations, investigations, explorations, tests, reports or similar information or data in respect of said Underground Facilities are or will be required by Bidder in order to perform and furnish the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of the General Conditions.

(5) Bidder has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.

(6) Bidder has given Architect/Engineer written notice to all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by Engineer/Architect is acceptable to Bidder.

(7) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid: Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

4. SOUTHAVEN ELEMENTARY SCHOOL CLASSROOM EXPANSION

5A. LUMP SUM BASE BID SHALL INCLUDE THE FOLLOWING UNIT PRICE ALLOWANCES:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Undercut Excavation	1,000	CY	$	$

TOTAL BID PRICE FOR UNIT PRICE ALLOWANCES INCLUSIVE IN WORDS:

_____

DOLLARS AND _____CENTS($_____).

5B. LUMP SUM BASE BID PRICE SHALL INCLUDE THE FOLLOWING ALLOWANCES:

1	Contingency Allowance for use according to Owner's Instructions	$30,000.00

5C. LUMP SUM BASE BID: The completed and related work, as indicated on the contract drawings and/or described in the Specifications for the following LUMP SUM BASE BID. The LUMP SUM BASE BID shall include the Total Bid Price for the Unit Price Allowances and the amount listed for Allowances in paragraph 5B.

DOLLARS AND _____CENTS($_____).

5. SELECTED SUBCONTRACTORS LIST

DESCRIPTION	COMPANY NAME	BUSINESS ADDRESS
Plumbing DIVISION 22		
Air Conditioning DIVISION 23		
Electrical DIVISION 26		

6. Receipt of the following Addenda is hereby acknowledged: _____
(Insert number of all addenda received; if no addenda received, insert "None".)

7. If awarded this Contract, I, (We), the Bidder, agree to execute a Contract and start Work on a date set to start in a Notice to Proceed which will be issued on or about FEBRUARY 8, 2017. Substantial Completion shall be achieved on or before JULY 27, 2017. Final Completion of the Phase 1 and Phase 2 Work shall be achieved on or before AUGUST 26, 2017, subject to the terms and conditions of the Contract.

   Bidder accepts the provisions of the "General Conditions of the Contract for Construction" as to liquidated damages in the event of failure to complete the Work on time. **Liquidated damages are set at $1,000.00 per calendar day beyond substantial completion and final completion.**

8. The following documents are attached to and made a condition of this Bid:

   (1) Required Bid Security in the form of 5% Bid Bond or Bank Check in the amount of 5% of the Bid.

9. Communications concerning this Bid shall be addressed to:

   The address of Bidder indicated below.

   The following address:

---

10. The terms used in this Bid which are defined in the General Conditions of the Construction Contract included as part of the Contract Documents have the meanings assigned to them in the General Conditions.

Submitted on _____, 20___.

If Bidder is:
An Individual:

_____
(Individual's Name)

_____(SEAL)
(Individual's Signature)

doing business as:

_____

Business address:

_____

_____

Phone No.:_____

A Partnership:

_____(SEAL)
(Firm Name)

By:_____
(Signature of General Partner)

Business address_____

_____

Phone No.:_____

A Corporation:

_____
(Corporation Name)

By:_____Title:_____
(Signature of person authorized to sign) (Corporate Seal)

Attest:

_____(Secretary)

_____
(State of Incorporation)

Business address:_____

_____

Phone No.:_____

A Joint Venture:

_____(SEAL)
(Joint Venture)

By:_____
(Signature of Joint Venturer)

_____ (Address)

By:_____
(Signature of Joint Venturer)

_____ (Address)

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

END OF SECTION

SECTION 00 5300

AGREEMENT FORM

1.1 DESCRIPTION

A. The Owner will use AIA Document A101, 2007 Edition, Standard Form of Agreement Between Owner and Contractor, where basis for Payment is a Stipulated Sum as a part of the Contract Documents.

B. A copy of this document is included herein, for form. All Bidders shall read and understand the referenced document.

C. The forms for the Payment Bond and Performance Bond shall be AIA Document A312 (Latest Edition) or equal.

END OF SECTION

AIA® Document A101™ – 2007

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the day of in the year 2016
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

DESOTO COUNTY SCHOOLS
DESOTO COUNTY, MISSISSIPPI
5 EAST SOUTH STREET
HERNANDO, MS 38632

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

SOUTHAVEN ELEMENTARY SCHOOL CLASSROOM EXPANSION
The Architect:
(Name, legal status, address and other information)

ALLEN & HOSHALL, PLLC
1661 INTERNATIONAL DRIVE SUITE 100
MEMPHIS, TENNESSEE 38120

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

A notice to proceed will be issued to fix the date of commencement of the work.

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

N/A

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than _____. -
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Final completion of the work being achieved on or before _____, subject to the terms and conditions of the contract.

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

Liquidated damages are set at $1000.00 per calendar day beyond substantial completion and final completion in the event of failure to complete the work on time.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

No Alternates

§ 4.3 Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit ($0.00)
n/a		

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Unit Price Allowances	Units and Limitations	Price per Unit ($0.00)
(Row deleted)		

Contingency Allowance	Price
Authorized Contract Amendments	$15,000.00

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 5th day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the 15th day of the same

month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than FORTY FIVE (45) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of five percent (5 %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of five percent (5 %);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

See Article 9, "payments and Completion" of the General Conditions of the Contract for Construction for terms of retainage reduction and limitations.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[X] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

per annum

§ 8.3 The Owner's representative:
(Name, address and other information)

Cory Uselton
5 E. South Street
Hernando, MS 38671

§ 8.4 The Contractor's representative:
(Name, address and other information)

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Date	Pages

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.
(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond	Limit of liability or bond amount ($0.00)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
Cory Uselton - Superintendent *(Printed name and title)*	*(Printed name and title)*

SECTION 00 7200

GENERAL CONDITIONS

1.1 DESCRIPTION

A. The General Conditions of the Contract for Construction, AIA Document A201, dated 2007 of the American Institute of Architects is attached.

B. Contractors are presumed to be familiar with this document.

C. All persons intending to provide goods or services in connection with this work are required to read and understand this document prior to proceeding.

END OF SECTION

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address):
SOUTHAVEN ELEMENTARY SCHOOL CLASSROOM EXPANSION

THE OWNER:
(Name and address):
DESOTO COUNTY SCHOOLS
DESOTO COUNTY, MISSISSIPPI

THE ARCHITECT:
(Name and address):
ALLEN & HOSHALL, PLLC
1661 INTERNATIONAL DRIVE #100
MEMPHIS, TENNESSEE 38120

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Init.
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INDEX

(Paragraph deleted)

(Numbers and Topics in Bold are Section Headings)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. The Contract Documents shall include the Instructions to Bidders, plans, the Project Manual, including Division O and the specifications, Divisions 1 through 16, all Addenda and modifications to the plans and/or specifications, the Agreement between Owner and Contractor, the performance and payment bonds, the Notice to Proceed and any executed change orders. Information and documentation pertaining to soil investigation data, laboratory investigations, soil borings and related information included herein are not part of the Contract Documents. In the event of a conflict between the provisions of Division 0 and any other section of the Contract Documents, such other sections shall govern.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect and Contractor, (2) between the Owner and a Subcontractor or Sub-subcontractor, (3) between the Owner and Architect or (4) between any persons or entities other than the Owner and Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 THE PROJECT MANUAL

The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

(Paragraphs deleted)

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1. The Agreement
2. The Addenda, with those of later date having precedence over those of earlier date.

3. The Supplementary Conditions.
4. The General conditions of the Contract for Construction.
5. Drawings and Specifications. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect's interpretation.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.
INSERT A: 1.2.4 Sections of Division 1 – General Requirements govern the execution of all sections of the Specifications.

§ 1.3 CAPITALIZATION

§ 1.3.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

§ 1.4.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 EXECUTION OF CONTRACT DOCUMENTS

§ 1.5.1 The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

§ 1.5.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.6.1 The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants, and unless otherwise indicated the Architect and the Architect's consultants shall be deemed the authors of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' copyrights or other reserved rights.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 The Owner shall, at the written request of the Contractor, prior to commencement of the Work and thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Furnishing of such evidence shall be a condition precedent to commencement or continuation of the Work. After such evidence has been furnished, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees, including those required under Section 3.7.1, which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys and geotechnical reports in his possession, upon Contractor's request, prepared for this project describing physical characteristics, legal limitations and utility locations for the site of the project, and a legal description. The Contractor shall obtain and pay for any additional information regarding the site needed for the performance of the work. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness. Any other information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be required to make copies of Contract Documents as necessary for execution of the Work. The Owner will provide digital copies for use by the Contractor for printing.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

§ 2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or fails to carry out Work in accordance with the Contract Documents or fails to perform any of its obligations under the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. The rights and remedies under this Article 2.3.1 are in addition to and do not in any respect limit any other rights of the Owner, including its termination rights under Article 14.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

§ 2.4.1 If the Contractor defaults or neglects to carry out the work in accordance with the Contract Documents and fails, within a 7-day period, after receipt of written notice from the Owner, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect

or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative. The relationship of Contractor to Owner shall be that of an independent Contractor, and nothing in the Contract Documents is intended to nor should be construed as creating any other relationship, expressed or implied, between Owner and Contractor.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Since the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect as a request for information in such form as the Architect may require.

§ 3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect.

§ 3.2.3 If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to Sections 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Sections 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Sections 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Architect. In no event shall the Owner be liable to the Contractor for alleged errors, omissions, inconsistencies, defects, or inadequacies in the Contract Documents to any greater extent than the Architect is liable to the Owner for same, and the limit of the Owner's liability to the Contractor shall not exceed the amount actually recovered by the Owner from the Architect.

(Paragraph deleted)

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods,

techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.4.4 Where "or equal" substitution is allowed by the technical specifications, the request for the substitution of materials, products or equipment in place of those specified will only be considered if made in strict accordance with all requirements of Section 01631 Substitutions.

§ 3.5 WARRANTY

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES AND NOTICES

§ 3.7.1 The Contractor shall secure and pay for the building permit and all other permits, fees, licenses, inspections and all other approvals and charges necessary for proper execution and completion of the work.

§ 3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 At no additional cost to the Owner, the Contractor shall comply with all laws, statutes, ordinances, building codes, safety requirements, rules and regulations of whatever nature that apply to the project, whether enacted or adopted before or after bid opening. If the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification.

§ 3.7.4 If the Contractor performs Work contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

3.7.5 The Owner shall pay plans review fees imposed by Local Building and/or Code Enforcement agency.

(Paragraph deleted)

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents:

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances;

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner in sufficient time to avoid delay in the Work.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case. The Contractor shall also employ a competent project manager who shall be primarily responsible for the Contractor's home office activities in connection with the Contract.

The Owner shall have the right, which shall be exercised in a reasonable fashion, to approve the project manager and/or superintendent employed by the Contractor, either before or during the progress of construction.

The superintendent and project manager for the project shall be designated by the Contractor at the pre-construction conference. After Owner's approval of such project manager and superintendent, they shall not be replaced by the Contractor without the Owner's prior written consent, which consent is required unless the Contractor submits proof satisfactory to the Owner that the superintendent and/or the project manager should be terminated by the Contractor for cause.

(Paragraphs deleted)

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare and keep current, for the Architect's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Architect reasonable time to review submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

§ 3.11.1 The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record field changes and selections made during construction, and one record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action.

§ 3.12.6 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's

responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

§ 3.13 USE OF SITE

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

§ 3.16 ACCESS TO WORK

§ 3.16.1 The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

§ 3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Section 11.3,

the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

§ 4.1 ARCHITECT

§ 4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a new Architect against whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the former Architect.

§ 4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications

by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect will have authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, will receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.3 CLAIMS AND DISPUTES

§ 4.3.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 4.3.2 Time Limits on Claims. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Architect and the other party.

§ 4.3.3 Continuing Contract Performance. Pending final resolution of a Claim except as otherwise agreed in writing or as provided in Section 9.7.1 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 4.3.4 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the Architect has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.4.

§ 4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.6.

§ 4.3.6 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Section 4.3.

§ 4.3.7 Claims for Additional Time

(Paragraph deleted)

§ 4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

§ 4.3.7.2 The Contractor assumes the risk of both normal and abnormal adverse weather and will not be entitled to any time extension or contract price adjustment for either normal or abnormal adverse weather encountered during construction.

§ 4.3.8 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 4.3.10 Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 4.3.10 shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 4.4 RESOLUTION OF CLAIMS AND DISPUTES

§ 4.4.1 Decision of Architect. Claims, including those alleging an error or omission by the Architect but excluding those arising under Sections 10.3 through 10.5, shall be referred initially to the Architect for decision. An initial decision by the Architect shall be required as a condition precedent to litigation of all Claims between the Contractor and Owner arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered by the Architect. The Architect will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 4.4.2 The Architect will review Claims and within ten days of the receipt of the Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Architect is unable to resolve the Claim if the Architect lacks sufficient information to evaluate the merits of the Claim or if the Architect concludes that, in the Architect's sole discretion, it would be inappropriate for the Architect to resolve the Claim.

§ 4.4.3 In evaluating Claims, the Architect may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect in rendering a decision. The Architect may request the Owner to authorize retention of such persons at the Owner's expense.

§ 4.4.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either provide a response on the requested supporting data, advise the Architect when the response or supporting data will be furnished or advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part within 30 days.

§ 4.4.5 The Architect will approve or reject Claims by written decision, which shall state the reasons therefor and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be final and binding on the parties but subject to mediation and arbitration.

§ 4.4.6 When a written decision of the Architect states that (1) the decision is final but subject to mediation and arbitration and (2) a demand for arbitration of a Claim covered by such decision must be made within 30 days after the date on which the party making the demand receives the final written decision, then failure to demand arbitration within said 30 days' period shall result in the Architect's decision becoming final and binding upon the Owner and Contractor. If the Architect renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence, but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.

§ 4.4.7 Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 4.4.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines prior to resolution of the Claim by the Architect, by mediation or by arbitration.

§ 4.5 MEDIATION

§ 4.5.1 Wherever "mediation" is referenced in these General conditions, the word is hereby deleted and replaced by the word "litigation".

§ 4.6 ARBITRATION

§ 4.6.1 Wherever "arbitration" is referenced in these General Conditions, the word is hereby deleted and replaced with the word "litigation".

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 The Contractor shall make no substitution for any subcontractor, supplier, person, or entity previously listed by Contractor on its bid without written consent of the Owner. The Contractor's unauthorized substitution of any subcontractor, supplier, person or entity previously listed by Contractor in its bid shall entitle Owner to reject the work of such subcontractor and/or the materials, product or equipment furnished by such supplier as nonconforming and to require removal and replacement at no additional cost to the Owner.

§ 5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitute.

§ 5.3 SUBCONTRACTUAL RELATIONS

§ 5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the

Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

(Paragraph deleted)

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

The Owner reserves the right to perform construction or operations related to the project with the Owner's own forces and to award separate Contracts either in connection with other portions of the project or other construction or operations on the site. In such event, the Contractor shall coordinate its activities with those of the Owner and of other Contractors so as to facilitate the general progress of all work being performed by all parties. Cooperation will be required in the arrangement for the storage of materials, and in the detailed execution of the work.

The Contractor, including his subcontractors, shall keep informed of the progress and the detailed work of other Contractors and shall immediately notify the Architect of lack of progress or delays by other Contractors which are affecting Contractor's work. Failure of Contractor to keep informed of the progress of the work of other Contractors and/or failure of Contractor to give notice of lack of progress or delays by other Contractors shall be deemed to be acceptance by Contractor of the status of progress by other Contactors for the proper coordination and completion of Contractor's work. If, through acts or neglect on the part of the Contractor, any other Contractor or subcontractor shall suffer loss or damage or assert any claims of whatever nature against the Owner, the Contractor shall defend, indemnify and hold harmless the Owner from any such claims or alleged damages, and the contractor shall resolve such alleged damages or claims directly with the other Contractors or subcontractors.

(Paragraphs deleted)

§ 6.3 OWNER'S RIGHT TO CLEAN UP

§ 6.3.1 If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect, stating their agreement upon all of the following:

.1 change in the Work;
.2 the amount of the adjustment, if any, in the Contract Sum; and
.3 the extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

7.2.3 In order to facilitate consideration of change order requests, all such requests, except those so minor that their propriety can be seen by inspection, must be accompanied by a complete itemization of costs including labor, materials and subcontracts which shall be itemized also. In no case will a change involving over $500.00 be approved without such itemization.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 unit prices stated in the Contract Documents or subsequently agreed upon;
.3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 as provided in Section 7.3.6.

§ 7.3.4 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect and the Owner of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.5 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an allowance for overhead and profit in accordance with the schedule set forth in subparagraph 7.3.6.6 below. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.6 shall be limited to the following:

.1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 additional costs of supervision and field office personnel directly attributable to the change.

7.3.6.6 In subparagraph above, the allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:

1. For the Contractor, for work performed by the Contractor's own forces, fifteen percent of the cost.
2. For the Contractor, for work performed by the subcontractor, ten percent of the amount due the subcontractor.
3. For each subcontractor or sub-subcontractor involved, for work performed by that Contractor's own forces, ten percent of the cost.
4. For each subcontractor, for work performed by his subcontractors' five percent of the amount due the sub-subcontractors.
5. Cost to which overhead and profit is to be applied shall be determined in accordance with subparagraph 7.3.6.

§ 7.3.7
(Paragraphs deleted)
The amount of credit to be given by the contractor to the Owner for a deletion or change which results in a net decrease n the Contract sum shall be the actual net cost plus reasonable allowance for overhead and profit as net costs saved as approved by the Architect and Owner. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.8 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with Article 4.

§ 7.3.9 When the Owner and Contractor agree with the determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

(Paragraph deleted)

§ 7.4 MINOR CHANGES IN THE WORK

§ 7.4.1 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect and Owner in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work and that the Contractor is fully capable of properly completing the work within the contract time.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed, hindered or impeded at any time in the progress of the work for any reason or by any alleged act or neglect of the Owner or the Architect, or by any employee of either or by a separate Contractor employed by the Owner, or by changes ordered in the scope of the work, or by other causes beyond the Contractor's control, then the contract time may be extended by change order for such reasonable time as is agreed to by the Owner. However, to the fullest extend permitted by law, and notwithstanding any other provisions in the contract documents, the Owner and its agents and employees shall not be liable for any damages for delay whether for direct or indirect costs, extended home office overhead, idle or inefficient labor or equipment, cost escalations, or monetary claims of any nature arising form or attributable to delay by any cause whatsoever, the Contractor's sole and exclusive right and remedy for delay by any cause whatsoever is an extension the contract time but no increase in the contract sum. Abnormal adverse weather shall not be grounds for contract time extensions.

§ 8.3.2

No delay, interference, hindrance or disruption, from whatever source or cause, in the progress of the Contractor's Work shall be a basis for an extension of time unless the delay, interference, hindrance or disruption is (1) without the fault and not the responsibility of the Contractor, its subcontractors and suppliers and (2) directly affects the overall completion of the Work as reflected on the critical path of the Contractor's updated and accepted construction schedules. The Contractor expressly agrees that the Owner shall have the benefit of any float in the construction schedule and delay to construction activities which do not affect the overall completion of the Work does not entitle the Contractor to any extension in the Contract Time.

§ 8.3.3

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

§ 9.1.1 The Contract sum is stated in the Agreement and, including executed adjustment, is the total amount under the Contract Documents. The Contractor hereby agrees that the Contract sum is full and adequate compensation to supply and furnish all labor, materials, equipment, tools, services and supervision and bear all items of expenses necessary or fairly and reasonable inferable for the complete performance of the work to the satisfaction of the Owner. The Contractor acknowledges that the Contract sum includes all items of general conditions and requirements, field overhead, home office overhead and all other time related expenses for the entire contract time established in the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

§ 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its

accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents. The form of Application for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet.

§ 9.3.1.1 As provided in Section 7.3.8, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Such applications may not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

9.3.1.3 The Owner will pay 95 percent (or that percent required by law, whichever is greater) of the amount due the Contractor on account of progress payments. If the manner of completion of the Work and its progress are and remain satisfactory to the Architect, and in the absence of other good and sufficient reasons, when the Work is shown to be 50 percent or more complete in the Application for Payment, the Owner shall allow retainage to be reduced to 2.5% until final payment.

9.3.1.4 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Architect and Owner or if the Surety withholds its consent, or for other good and sufficient reasons.

9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work.

Within the county where the project is located, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site. Proof of payment of stored materials verified by the supplier must be furnished to the Architect within 30 days of the Application for Payment on which payment for said materials was made. If proof of payment is not furnished within the 30-day period, payment for said materials will be deducted from the next Application for Payment and withheld until proof of payment is provided.

INSERT C: 9.3.2.1 Payment for materials stored off the site shall be conditioned upon compliance with the following requirements:

1. Stored items shall be protected from diversion, destruction, theft, and damage.
2. Stored items shall be specifically marked or otherwise identified for incorporation into the work.
3. Stored items shall be available for inspection by the Architect and Owner.
4. Copies of bill of sale or other proof of purchase for stored items shall be submitted to the Architect and Owner.
5. Certificates of installation floater insurance for the stored items, protecting against damage and theft while in storage, certifying said coverage, and indicating the nature, quantity, and exact location of the stored items. Shall be submitted to the Architect and Owner.
6. A waiver of lien from the Contractor and supplier of stored items shall be provided in accordance with the Contact Documents.

INSERT D: 9.3.2.2 The Contractor shall obtain written consent of Surety prior to implementation of the provisions contained in clause 9.3.2.1 for payment for materials stored off site.

(Paragraph deleted)

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or another contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** failure to carry out the Work in accordance with the Contract Documents.

INSERT E: 8 Failure to prepare, maintain, and/or update the Progress Schedule.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

(Paragraph deleted)

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

9.6.1.1 Subject to the conditions of the Contract, the Owner shall make payment to the Contractor in the amount certified within thirty (30) days after receipt of Certificate for Payment from the Architect. Payment shall not be considered late until 30 days after Owner's receipt of Certificate for Payment from the Architect.

§ 9.6.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

§ 9.7.1 If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by arbitration, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. Substantial completion for purposes of this Contract occurs when the Architect certifies that the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended purpose. Such certification shall be given through issuance of a "Certificate of Substantial Completion".

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

9.8.2.1 Contractor Responsibility for Additional Services of the Architect for Failure to Achieve Final Acceptance/Completion of Project:

The Contractor shall be responsible for the costs of inspections made by the Architect including any and all other related services expenses incurred by the Architect for providing services for the project required by failure of the contractor to achieve final acceptance/completion of the project within 30 days after the first occurring of the below described events:

1. Date of estimated/specified date of substantial completion.
2. Date of actual substantial completion.

The above described costs of the Architect's additional services shall be deducted by the Owner from the Contractor's final application for payment to pay the Architect for additional services required by the Contractor's failure to achieve final completion of the project within the 30 day period described above.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

9.8.3.1 Upon the Owner's acceptance of the Work as substantially complete and upon Contractor's compliance
with all conditions precedent to substantial completion as stated in Section 00800, Paragraph 1.2.I.5. and upon application by the Contractor, the Owner will pay to the Contractor all retainage held by the Owner less an amount equal to the greater of (a) two and one-half percent (2.5%) of the Contract sum, or (b) two hundred percent (200%) of the cost of the Work remaining to be performed by the Contractor in accordance with the Architect's determination. Final payment, including all retainage, shall be made at the time and in the manner provided for final payment in accordance with the provisions of Article 9.10. and as additional conditions precedent to final acceptance/payment of the Project appear in Section 00800, Paragraph 1.2.I.6.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate.

Warranties required by the Contract Documents shall commence on the date of final acceptance/completion unless otherwise provided in the Contract Documents. Except where otherwise noted warranty time periods shall be as follows: General Construction – One (1) year from date of Final Acceptance/Completion; Roof System – Three (3) years from date of Final Acceptance/Completion.
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§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Contractor's execution of the Certificate of Substantial Completion constitutes Contractor's representation that the items on the list accompanying the Certificate can and will be completed by Contractor and his subcontractors within thirty (30) days of Contractor's execution of the Certificate. Based upon this representation by Contractor and upon the acknowledgment of the

Architect that the listed items remaining can be completed within thirty (30) days, the Owner agrees to execute the Certificate of Substantial Completion. If Contractor fails to complete the items on the list within thirty (30) days of Contractor's execution of the Certificate, then the Owner, at its option and without prejudice to any other rights or remedies it may have under this Contract or otherwise and without notice to Contractor, may proceed to have same completed and to deduct the reasonable costs thereof from the amounts then due or thereafter to become due to Contractor. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.4.1.5 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

9.9.1.2 The Owner's occupancy or use of any completed or partially completed portions of the Work shall not affect Contractor's obligation to complete incomplete items on the list attached to the Certificate of Substantial Completion within the time fixed in the certificate and does not waive Owner's right to obtain completion of incomplete items at Contractor's expense upon Contractor's failure to timely complete same.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after

payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

9.10.2.1 Final acceptance/completion for purposes of this Contract occurs only upon Contractor's compliance with the following conditions precedent: (a) the Contractor furnishes to the Architect all required close out documents in a form satisfactory to the Architect and the Owner; (b) the Contractor furnishes the required manufacturers' certifications (c) the Contractor furnishes the signed Guarantee of Work required by Section 00800, Paragraph 1.2.K.2; (d) the Architect certifies final acceptance/completion through issuance of a "Certificate of Final Completion".

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents; or

.3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

9.11.1 Liquidated Damages. Time being of the essence of this Contract and a matter of material consideration thereof, a reasonable estimate in advance is established to cover losses incurred by the Owner if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor and his Surety will be liable for and will pay the Owner the sums hereinafter stipulated as fixed and agreed as liquidated damages for each calendar day for delay until the Work is substantially complete. The Contractor and his Surety acknowledge that the Owner's losses caused by the Contractor's delay are not readily ascertainable and that the amount estimated per day for liquidated damages is reasonable and is not a penalty.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

§ 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and

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

§ 10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

10.2.4.1 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary, the Contractor shall give the Owner reasonable advance notice.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

(Paragraphs deleted)

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 The Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. The Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up, which adjustments shall be accomplished as provided in Article 7.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) and provided that such damage, loss or expense is not due to the sole negligence of a party seeking indemnity.

(Paragraphs deleted)

§ 10.4 The Owner shall not be responsible under Section 10.3 for materials and substances brought to the site by the Contractor unless such materials or substances were required by the Contract Documents.

§ 10.5 If, without negligence on the part of the Contractor, the Contractor is held liable for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.6 EMERGENCIES

§ 10.6.1 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Section 4.3 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business State of Mississippi such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;

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

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

.4 claims for damages insured by usual personal injury liability coverage;

.5 claims for damagesbecause of injury to or destruction of tangible property, including loss of use resulting therefrom;

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

.7 claims for bodily injury or property damage arising out of completed operations; and

.8 claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

.9 Liability insurance will include all major divisions of coverage and be on a comprehensive basis

including:

1. Premises - Operations (including X-C-U).
2. Independent Contractor's Protective.
3. Products and Completed Operations.
4. Contractual (including specified provisions for the Contractor's obligations under Paragraph 3.18).
5. Owned, Non-Owned and Hired Motor Vehicles.
6. Broad Form Coverage for Property Damage.

§ 11.1.2

The insurance required by subparagraph 11.1.1 will be written for not less than the following or will be greater if required by law:

.1 Workmen's Compensation

A. Workmen's Compensation-Statutory Coverage

B.Employer's Liability =$100,000 each accident or occurrence

.2 Comprehensive General Liability

A. Bodily Injury =$500,000 each person $500,000 each occurrence
B. Personal Injury = $500,000 each person $500,000 aggregate
C. Property Damage = $100,000 each occurrence $100,000 aggregate
D. Umbrella = For projects whose Contract amount is in excess of $500,000, provide a $1,000,000 umbrella coverage.

.4 Independent Contractors - Same limits as above.

.5 Products and Completed Operations - Same limits as above, commencing with issuance of Final Certificate of Payment.

.6 Automobile Liability

A. Bodily Injury =$250,000 each person $500,000 each occurrence or $500,000 combined single unit
B. Property Damage = $100,000 each occurrence

.7 Contractual Liability - Same limits as above.

Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

11.1.4. The Ownerand the Architect/Engineer shall be named as an additional insured and Contractor shall furnish one copy of certificate herein required for each copy of the Agreement, specifically setting forth evidence of all coverage required by Articles 11.1.1, 11.1.2, and 11.1.1.8. Furnish to the Owner copies of any endorsements that are subsequently issued amending coverage.

(Paragraph deleted)

§ 11.2 OWNER'S LIABILITY INSURANCE

(Paragraph deleted)

§ 11.2.1

The Contractor will pay for and maintain such insurance as will protect the Owner from his contingent liability to others for damages because of bodily injury, including death, which may arise from operations under this Contract and other liability for damages which the Contractor is required to insure under any provisions of this Contract. Certificate of this insurance will be filed with the Owner and will be the same limits set forth in 11.1.2.

§ 11.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

§ 11.3.1 Optionally, the Owner may require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Architect's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage, and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with

such coverage shall be equal to the aggregate of the limits required for Contractor's Liability Insurance under Sections 11.1.1.2 through 11.1.1.5.

(Paragraphs deleted)

§ 11.3.2 To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Architect waive all rights against each other for damages, except such rights as they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

§ 11.3.3 The Owner shall not require the Contractor to include the Owner, Architect or other persons or entities as additional insureds on the Contractor's Liability Insurance coverage under Section 11.1.

(Paragraphs deleted)

§ 11.4 PROPERTY INSURANCE

§ 11.4.1 Unless otherwise provided, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.4 to be covered, whichever is later. This insurance shall include interests of the Owner, Architects, Engineers and their Consultants, the Contractor, Subcontractors and Sub-subcontractors in the Project.

(Paragraph deleted)

§ 11.4.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.4.1.3 If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

§ 11.4.1.4 The Contractor shall provide insurance coverage for portions of the work stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the work in transit.

§ 11.4.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.4.7 Waivers of Subrogation. The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.4 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.4.8 A loss insured under Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.4.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.4.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or in accordance with an arbitration award in which case the procedure shall be as provided in Section 4.6. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.4.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power;

§ 11.5 PERFORMANCE BOND AND PAYMENT BOND

§ 11.5.1 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power-of-attorney.

INSERT F: 11.5.1.1 The Contractor shall provide an alternate surety acceptable to the Owner if surety is disqualified from doing business in the State of Mississippi or shall become rated less than a "A" by "Best's Insurance Reports".

INSERT G: 11.5.1.2 The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the work, submit evidence satisfactorily to the Owner that such bonds will be furnished.

§ 11.5.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered which the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

§ 12.2.1.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

12.2.2.4. Prior to the end of the one-year period (three-year for roofs), the Architect may schedule a warranty inspection which shall be attended by the Architect, the Owner, the Contractor and all major subcontractors. During this inspection, the parties shall identify all defective and/or nonconforming items and fix a time within which all defective and/or nonconforming items shall be repaired and/or replaced.

12.2.2.5. As a condition to final completion of the Work, Contractor, upon completion of the work, shall prepare and submit to the Owner a Guarantee of Work, sworn to by the Contractor, stating:

Contractor and Contractor's Surety hereby guarantee that all Work performed on the above captioned project is free from defective and/or nonconforming materials and workmanship and that for a period of one year for building construction, three years for roof system from the date of final completion or such longer period of time as may be called for in the Contract Documents for such portions of the work, Contractor will repair and/or replace any defective and/or nonconforming materials and workmanship in accordance with the requirements of the Contract Documents."

12.2.2.6. Within the one-year period (three-year for roofs), if repairs or replacement are requested by Owner in connection with guaranteed work which, in the opinion of the Owner, are rendered necessary as a result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the Contract Documents, the Contractor shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition in every particular, all such guaranteed work, correct all defects therein and make good all damages to the building, site, equipment or contents thereof which, in the opinion of the Owner, are the result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the terms of the Contract Documents; and make good any work or materials or the equipment and contents of said buildings or site disturbed in fulfilling any such guaranty. If, after notice or within the time agreed upon by the parties at the warranty inspection, the Contractor and/or its Surety fail to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected in accordance with Article 2.4 and the Contractor and his Surety shall be liable for all expenses incurred. All special guarantees applicable to definite parts of the work stipulated in the Contract Documents shall be subject to the terms of this paragraph during the first year of the life of such special guarantee.

§ 12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

§ 12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

§ 13.1.1 The Contract shall be governed by the law of the place where the Project is located.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to an institutional lender providing construction financing for the Project. In such event, the lender shall assume the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

§ 13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection

or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

§ 13.6.1 Payments due and unpaid under the Contract Documents shall bear interest as provided by Mississippi Code, Section 31-5-25 or Section 87-7-3, whichever applies.

§ 13.7

(Paragraphs deleted)

COMMENCEMENT OF STATUTORY LIMITATION PERIOD

§ 13.7.1 As between the Owner and Contractor:

.1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

.2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and

.3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

INSERT I: 13.8.1 The Contractor and the contractor's subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to race, religion, color, sex, or national origin. Such action shall include, but not limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to pose inconspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

13.8.2 The prevailing party in any dispute between the parties arising out of or related to this Agreement, or the breach thereof, shall be entitled to reasonable attorneys' fees and expenses incurred in pursuing or defending any claim.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

(Paragraphs deleted)

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

(Paragraphs deleted)

§ 14.2.1 The Owner may terminate the Contract if the Contractor:

.1 refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

.5 fails to achieve substantial completion of the Project as described in Article 9.8 within the time limit agreed upon and/or fails to complete the list of items attached to the Certificate of Substantial Completion within the time fixed in the Certificate of Substantial Completion;

.6 fails to meet any deadline required by the Contract. Contractor acknowledges that time is of the essence of this Contract and that all deadlines required by the Contract are critical to timely completion of the Contract. Therefore, Contractor agrees that its failure to meet any deadline constitutes a substantial and material breach of this Contract, entitling the Owner to terminate the Contract.

§ 14.2.2 When any of the above reasons exist, the Owner, upon advice by the Architect that sufficient cause exists to justify such actions, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 accept assignment of subcontracts pursuant to Section 5.4; and

.3 finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

14.2.5 If the Owner terminates the Contract for cause, and it is determined for any reason that the Contractor was not actually in default under the Contract at the time of termination, the Contractor shall be entitled to recover from the Owner the same amount as the Contractor would be entitled to receive under a termination for convenience as provided by Article 14.4.3. The foregoing shall constitute the Contractor's sole and exclusive remedy for termination of the Contract. In no event shall the Contractor be entitled to special, consequential, or exemplary damages, nor shall the Contractor be entitled to anticipated profits resulting from termination of this Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, without cause or fault of either the Contractor or the Owner, terminate the Contract in whole or in part if the Owner, in its sole discretion, determines it to be in the Owner's best interest.

14.4.2 Upon the Owner's termination for convenience, the Contractor shall only be entitled to payment as provided in Subparagraph 14.1.2.

(Paragraphs deleted)

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for reasonable profit and overhead on Work performed ,. The Contractor shall not be entitled to receive any payment for either overhead or profit on work not performed.

(Paragraphs deleted)

SECTION 01 0250

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Measurement and payment criteria applicable to portions of the work performed under a unit price payment method.

B. Defect assessment and non-payment for rejected work.

1.2 RELATED DOCUMENTS

A. Document 00 53 00 - AGREEMENT FORM - Unit Price Amount.

1.3 AUTHORITY

A. Measurement methods delineated in the individual specification sections are intended to complement the criteria of this section. In the event of conflict, the requirements of the individual specification section shall govern.

B. Take all measurements and compute quantities. The Architect\Engineer will verify measurements and quantities.

C. Assist by providing necessary equipment, workers, and survey personnel as required.

1.4 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Architect\Engineer determine payment.

B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

1.5 MEASUREMENT OF QUANTITIES

A. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

1.6 PAYMENT

A. Payment Includes: Full compensation for all required labor, Products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the work; overhead and profit.

B. Final payment for work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the Architect/Engineer multiplied by the unit sum/price for work which is incorporated in or made necessary by the work.

1.7 SCHEDULE OF UNIT PRICES

A. Item 1: Undercut Excavation

1. Unit price bid for Undercut Excavation shall be considered full compensation for excavation and disposal of unsuitable soil, replacement with suitable material obtained from on-site

earthwork operation or suitable off-site borrow material, and compaction in accordance with earthwork specification.

2. Unit of Measure: Cubic yards of backfill compacted in place.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 0270

APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.1 RELATED SECTIONS

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

1.2 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. This Section specifies administrative and procedural requirements governing contractor's Applications for Payment.
1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

C Related Sections: The following Sections contain requirements that relate to this Section.
1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 01 Section "Submittals."

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor’s Construction Schedule.

B. Coordination: Contractor shall coordinate preparation of its Schedule of Values for its part of the Work with preparation of the Contractors' Construction Schedule.
1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
   a. Contractor's Construction Schedule.
   b. Application for Payment forms, including Continuation Sheets.
   c. List of subcontractors.
   d. Schedule of allowances.
   e. Schedule of alternates.
   f. List of products.
   g. List of principal suppliers and fabricators.
   h. Schedule of submittals.
2. Submit the Schedule of Values to the Architect at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.
3. Subschedules: Where work is separated into phases requiring separately phased
4. payments, provide subschedules showing values correlated with each phase of payment.

C. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section. Provide breakout of general conditions such as taxes, bond and insurance.
1. Identification: Include the following Project identification on the Schedule of Values:
a. Project name and location.
b. Name of the Architect.
c. Project number.
d. Contractor's name and address.

e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the ` foll owing for each item listed:
   a. Related Specification Section or Division.
   b. Description of Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.
      1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3.. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
5. 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. Include requirments for insurance and bonded warehousing, if required.
6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the work.
7. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.
8. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

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

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

1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit 4 signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate in formation related to the application, in a manner acceptable to the Architect.

F. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
   1. List of subcontractors.
   2. List of principal suppliers and fabricators.
   3. Schedule of Values.
   4. Contractor's Construction Schedule.
   5. Schedule of principal products.
   6. Schedule of unit prices.
   7. Submittal Schedule.
   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 governing authorities for performance of the Work.
   12. Report of preconstruction meeting.

G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment in accordance with General Conditions 9.8.3.1.
   1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the work.

H. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
   1. Completion of Project closeout requirements.
   2. Completion of items specified for completion after Substantial Completion.
   3. Ensure that unsettled claims will be settled.
   4. Ensure that incomplete work is not accepted and will be completed without undue delay.
   5. Transmittal of required project construction records to the Owner.
   6. Certified property survey.
   7. Proof that taxes, fees, and similar obligations were paid.
   8. Removal of temporary facilities and services.
   9. Removal of surplus materials, rubbish, and similar elements.
   10. Change of door locks to Owner's access.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 1100

SUMMARY OF WORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The project consists of: The construction of a 4 classroom expansion of approximately 3,200 square feet. Addition has associated sitework which includes grading, drainage, utilities and other related work, as shown on the drawings and/or described in the specifications
   1. Project Location: Desoto County, Mississippi.
   2. Owner: Desoto County School District, 5 East South Street, Hernando, MS 38632.

B. Contract Documents, dated DECEMBER 6, 2016, were prepared for the project by Allen & Hoshall, PLLC, 1661 International Drive Suite 100, Memphis, Tennessee 38120.

C. The work will be constructed under a single prime contract.

1.3 WORK SEQUENCE

A. Except as may be indicated otherwise, the work will be conducted in one phase.

B. Completion of the building construction may be phased in order to allow time for the Owner to move in equipment, furniture and incidentals prior to the start of school.

1.4 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site except as described in the specifications or indicated on the drawings. See drawings pertaining to coordination and phasing for restriction of site premises. The Contractor's use of the premises may be limited by the Owner's right to perform work or to retain other contractors on portions of the Project.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 2100

ALLOWANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes administrative and procedural requirements governing allowances. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Unit-price allowances.
   2. Contingency allowances.
   3. Lump Sum Allowance

1.2 RELATED SECTIONS

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

B. Division 01 Section "Modification Procedures" specifies procedures for submitting and handling Change Orders.

1.3 ADDITIONAL COST

A. Contractor shall include in their bid all general conditions such as: Overhead, profit, bonds, taxes, insurance, etc. These items shall not be included in the allowance itself.

1.4 SELECTION AND PURCHASE

A. Coordinate the requirement below with Division 01 Section "Submittals" (or Section "Schedules and Reports" if the Supplemental Section is used). Indicate critical dates on both the Contractor's Construction Schedule and the Submittal Schedule.

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

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

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

1.5 SUBMITTALS

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

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

1.6 UNIT PRICE ALLOWANCES

A. Unit price allowances are established for work that may be required but for which a quantity can not be determinted prior to bidding. The quantity indicated on the Bid Form is an estimate. The actual quantity may be more or less than the quantity indicated. The Contractor will be p aid for the actual quantity of work performed at the unit price bid.

B. The unit price bid for Unit Price Allowances shall be considered the full price for the work as described herein and or elsewhere in the specification with no additional additives or mark up.

C. At project closeout, credit unused amounts in the unit price allowances to the Owner by Change Order.

1.7 CONTINGENCY ALLOWANCES

A. Delete the following requirement on projects where contingency allowances have not been established in the Contract Sum. See Evaluations for discussion on using contingency allowances.

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

C. Retain the following requirements because contingency allowances differ from lump-sum and unit-cost allowances. The Contractor does not know what the Owner will use contingency allowances for when preparing the bid. The next two paragraphs provide an equitable way to reimburse the Contractor for unknown costs associated with contingency allowances. See Evaluations for further discussion.

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

E. Change Orders authorizing use of funds from the contingency allowance will not include Contractor's related costs and overhead and profit margins. These items should already be included in the bid.

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

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. Unit Price Allowance for Undercut Excavation: Include Unit Price Allowance for Undercut Excavation as required by site conditions and approved by the Owner.

B. Contingency Allowance: $30,000 for use according to the Owner's instructions.

END OF SECTION

SECTION 01 2305

MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Allowances" for procedural requirements governing the handling and processing of allowances.
   2. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
   3. Division 1 Section "Applications for Payment" for administrative procedures governing Applications for Payment.
   4. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 MINOR CHANGES IN THE WORK

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

1.4 CHANGE ORDER PROPOSAL REQUESTS

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

   1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
   2. Within 10 calendar days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
      a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time-Ractor-Initiated Proposals: When latent or unforseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
         1. Include a statement outlining the 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 Contract Time.

2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.

B. Proposal Request Form: Use AIA Document G709 or similar for Change Order Proposal Requests.

1.5 ALLOWANCES

A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in the purchase amount only where indicated as part of the allowance.
2. When requested, prepare explanations and documentation to substantiate the margins' claimed.
3. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.
4. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 21 days.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order.
1. The Construction Change Directive contains a complete description of the change in the work. It also designates the method to be followed to determine change in the Contract Sum or 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 the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.7 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 2340

COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
   1. General project coordination procedures.
   2. Conservation.
   3. Coordination Drawings.
   4. Administrative and supervisory personnel.
   5. Cleaning and protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Field Engineering" specifies procedures for field engineering services, including establishment of benchmarks and control points.
   2. Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and preinstallation conferences.
   3. Division 1 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
   4. Division 1 Section "Materials and Equipment" for coordinating general installation.
   5. Division 1 Section "Contract Closeout" for coordinating contract closeout.

C. See plans for additional coordination requirements especially coordination with other construction contracts and utility contracts associated with development of this project.

1.2 COORDINATION

A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in the 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 assure maximum accessibility for required maintenance, service, and repair.
   3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate contractors where 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 assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.

2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorpo rated in, the work.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
1. Show the relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in Section "Submittals."

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other per sonnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Coordinate scheduling, submittals, and work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Coordinate completion and clean up of work of separate Sections in preparation for substantial Completion and for portions of work designated for Owners partial occupancy.

C. After Owner occupancy of premises, coordinate access to site for correction of effective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period

C. Limiting Exposures: Supervise construction operations to assure that no part of the construc tion, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period

END OF SECTION

SECTION 01 3120

PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
   1. Preconstruction conferences.
   2. Preinstallation conferences.
   3. Progress meetings.
   4. Coordination meetings.

B. Related Sections:
   1. Division 01 Section "Coordination" for procedures for coordinating project meetings with other construction activities.
   2. Division 01 Section "Submittals" for submitting the Contractor's Construction Schedule.
   3. Division 07 Section "Roofing" for preinstallation roofing conferences.

1.3 PRECONSTRUCTION CONFERENCE

A. Schedule a preconstruction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 15 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; 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.

1.4 PREINSTALLATION CONFERENCES

A. Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.

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, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related Change Orders.
      d. Purchases.
      e. Deliveries.
      f. Shop Drawings, Product Data, and quality-control samples.
      g. Review of mockups.
      h. Possible conflicts.
      i. Compatibility problems.
      j. Time schedules.
      k. Weather limitations.
      l. Manufacturer's recommendations.
      m. Warranty requirements.
      n. Compatibility of materials.
      o. Acceptability of substrates.
      p. Temporary facilities.
      q. Space and access limitations.
      r. Governing regulations.
      s. Safety.
      t. Inspecting and testing requirements.
      u. Required performance results.
      v. Recording requirements.
      w. Protection.
   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 MONTHLY PROGRESS MEETINGS

A. Conduct progress meetings at the Project Site on a monthly basis. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

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. Deter

mine 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.

1.6 CONTRACT CLOSEOUT MEETING:

A. Conduct a contract closeout meeting at the project site within 30 days after substantial completion.

B. Attendees – Authorized representatives of the Owner, Architect, Contractor and any other personnel involved in maintenance and operation of all systems in the project.

C. Agenda – Discuss items of significance affecting contract closeout:
   1. Section 01700 Contract Closeout.
   1. Request for Final Inspection.
   2. Final change orders and contingency allowance.
   3. Project record documents, operations and maintenance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 3300

SUBMITTALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

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.

B. Administrative Submittals: Refer to other Division 01 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. With mutual agreement of the Contractor and Architect, submittals may be processed electronically. If so, the same basic principals established herein shall be followed with the electronic submittal process. The details of said process shall be developed prior to beginning transmittal of the submittal documents for review.

1.2 RELATED SECTIONS

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

1.3 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
   1. Preparation of Coordination Drawings is specified in Division 01 Section "Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not samples.

1.4 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 resubmit tals.
   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.

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 (100 by 125 mm) 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. Number and title of appropriate Specification Section.
   i. 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 certification that information complies with Contract Document requirements.

1.5 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. Phasing: On the schedule, show how requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner affect the sequence of work.

C. Work Stages: Indicate important stages of construction for each major portion of the work, including submittal review, testing, and installation.

D. 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.

E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.
1. Refer to Division 01 Section "Applications for Payment" for cost reporting and payment procedures.

F. 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.

G. 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 revison.

1.6 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.

1.7 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, sched ules, 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
   7. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. The Architect will retain 2 prints and return the remainder.
   8. Final Submittal: Submit quantity of documents needed by contractor plus one (1) for record documents and the Architect will retain 2 prints and return the remainder.
      a. One of the prints returned shall be marked up and maintained as a "Record Document."
   9. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.8 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. Application of testing agency labels and seals.
      e. Notation of dimensions verified by field measurement.
      f. Notation of coordination requirements.
   2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
   3. Submittals: Submit quantity of documents needed by contractor plus one (1) for record documents and the Architect will retain two (2) prints and return the remainder.
      a. One of the prints returned shall be marked up and maintained as a “Record Docment”.
   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.

1.9 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically iden tical 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. Mount or display Samples in the manner to facilitate review of qualities indicated. Pre pare Samples to match the Architect's sample. Include the following:
      a. Specification Section number and reference.
      b. Generic description of the Sample.
      c. Sample source.
      d. Product name or name of the manufacturer.
      e. Compliance with recognized standards.
      f. Availability and delivery time.
   2. 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 in-stalled.
      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 ap-proximate limits of the variations.
      b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
      c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
      d. Samples not incorporated into the work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
   3. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
      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, manufac-turers, fabricators, suppliers, installers, and others as required for performance of the work. Show distribution on transmittal forms.
   1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or fin-ish materials and to establish the project standard.
      a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instruct tions, 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 in-dividual 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."

1.11 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.

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 "Reviewed," 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 "Furnish as Corrected," 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 "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 necessary to obtain different action mark.
   4. Rejection of Submittal: When the Architect marks a submittal, “Rejected”, do not proceed with work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Prepare new submittal and submit to the Architect for review.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 4100

TESTING LABORATORY SERVICES – OWNER PAYS

PART 1 GENERAL

1.1 SUMMARY

A. This Section describes testing and inspecting required by the contract documents, plus cooperation required from the Contractor with the Owner's selected testing agency and others responsible for testing and inspecting the Work.

B. Testing and Inspecting shall be performed by an Independent Testing Agency selected by the Owner and paid by the Owner under a separate agreement between the Owner and Testing Agency.

C. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Requirements for testing may be described in various Sections of these Specifications.
   3. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this Section.

D. Work not included:
   1. Selection of testing laboratory: The Owner will select a qualified independent testing laboratory.
   2. Selection of construction soil engineer: The Owner will select a qualified independent soil engineer to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

1.2 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E 329.

B. Testing, when required, will be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.

1.3 DELIVERY, STORAGE, AND HANDLING

A. The testing agency will process and distribute required copies of test reports and related instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

PART 2 PRODUCTS

2.1 PAYMENT FOR TESTING

A. Initial services of testing laboratory:
   1. The Owner will pay for initial services requested by the Owner and required by the contract documents.
   2. When initial tests indicate non-compliance with the Contract Documents, the costs of all tests associated with that non-compliance may be deducted by the Owner from the Contract Price.

B. Retesting: When initial tests indicate non-compliance with the Contract Documents, subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency, and costs thereof will be deducted by the Owner from the Contract Price.

2.2 CODE COMPLIANCE TESTING

A. Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

2.3 CONTRACTOR'S CONVENIENCE TESTING

A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3 EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY

A. Representatives of the testing laboratory shall have access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

3.2 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

3.3 SCHEDULES FOR TESTING

A. Establishing schedules:
   1. By advance discussions with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.
   2. Provide all required time within the construction schedule.

B. Revising schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to schedule: When the testing laboratory is ready to test according to the established schedule, but it is prevented from testing or taking specimens due to incompleteness of the work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

END OF SECTION

SECTION 01 4210

REFERENCE STANDARDS AND DEFINITIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other

1.2 DEFINITIONS

A. General: Basic contract definitions are included in the Conditions of the Contract.

B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.

D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
   1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
   2. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the project.

The extent of the project site is shown on the Drawings and may or may not be identical with the description of the land on which the project is to be built.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections ``based on the 16-division format and CSI/CSC's "MasterFormat" numbering system.

B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Section Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
      a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

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B. Publication Dates: Comply with standards in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

F. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following abbreviations and acronyms, as referenced in the Contract Documents, mean the associated names. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association 900 19th St., NW, Suite 300 Washington, DC 20006 www.aluminum.org	(202) 862-5100
AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 www.aamanet.org	(847) 303-5664
ABMA	American Boiler Manufacturers Association 950 North Glebe Rd., Suite 160 Arlington, VA 22203-1824 www.abma.com	(703) 522-7350
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094 www.aci-int.org	(248) 848-3700
AFPA	American Forest and Paper Association (Formerly: National Forest Products Association) 1111 19th St., NW, Suite 800 Washington, DC 20036	(800) 878-8878 (202) 463-2700
AGA	American Gas Association 1515 Wilson Blvd. Arlington, VA 22209 www.aga.com	(703) 841-8400
AHA	American Hardboard Association 1210 W. Northwest Hwy Palatine, IL 60067-1897	(847) 934-8800
AI	Asphalt Institute Research Park Dr. P.O. Box 14052 Lexington, KY 40512-4052 www.asphaltinstitute.org	(606) 288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292 www.aia.org	(202) 626-7300
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001	(800) 644-2400 (312) 670-2400

AISI	American Iron and Steel Institute 1101 17th St., NW Washington, DC 20036-4700 www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112 www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America 12200 Sunrise Valley Dr., Suite 150 Reston, VA 20191 www.alca.org	(703) 620-6363
ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, MD 20875	(301) 972-1700
ANLA	American Nursery and Landscape Association (Formerly: American Association of Nurserymen) 1250 Eye St., NW, Suite 500 Washington, DC 20005	(202) 789-2900
ANSI	American National Standards Institute 11 West 42nd St., 13th Floor New York, NY 10036-8002 www.ansi.org	(212) 642-4900
APA	APA-The Engineered Wood Association (Formerly: American Plywood Association) P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	(206) 565-6600
APA	Architectural Precast Association P.O. Box 08669 Fort Myers, FL 33908-0669	(941) 454-6989
ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Dr., Suite 425 Arlington, VA 22203 www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association Center Park 4041 Powder Mill Rd., Suite 404 Calverton, MD 20705	(301) 231-9050
ASCE	American Society of Civil Engineers-World Headquarters 1801 Alexander Bell Dr. Reston, VA 20191-4400 www.asce.org	(800) 548-2723 (703) 295-6000

ASHRAE	American Society of Heating, Refrigerating and Air- Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329-2305 www.ashrae.org	(800) 527-4723 (404) 636-8400
ASLA	American Society of Landscape Architects 4401 Connecticut Ave., NW, 5th Floor Washington, DC 20008-2369 www.asla.org	(202) 686-2752
ASME	American Society of Mechanical Engineers 345 East 47th St. New York, NY 10017-2392 www.asme.org	(800) 434-2763 (212) 705-7722
ASPA	American Sod Producers Association (See TPI)	
ASPE	American Society of Plumbing Engineers 3617 Thousand Oaks Blvd., Suite 210 Westlake Village, CA 91362-3649	(805) 495-7120
ASQC	American Society for Quality Control 611 East Wisconsin, Ave. Milwaukee, WI 53201-3005 www.asqc.org	(800) 248-1946 (414) 272-8575
ASSE	American Society of Sanitary Engineering 28901 Clemens Rd. Westlake, OH 44145 www.asse-plumbing.org	(216) 835-3040
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 www.astm.org	(610) 832-9500
AWI	Architectural Woodwork Institute 1952 Isaac Newton Sq. Reston, VA 20190 www.awinet.org	(703) 733-0600
AWPA	American Wood Preservers' Association 3246 Fall Creek Hwy, Suite 1900 Granbury, TX 76049-7979	(817) 326-6300
AWS	American Welding Society 550 NW LeJeune Rd. Miami, FL 33126 www.amweld.org	(800) 443-9353 (305) 443-9353

AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235 www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association 355 Lexington Ave., 17th Floor New York, NY 10017-6603	(212) 661-4261
BIA	Brick Institute of America 11490 Commerce Park Dr. Reston, VA 22091-1525 www.bia.org	(703) 620-0010
CDA	Copper Development Association, Inc. 260 Madison Ave., 16th Floor New York, NY 10016-2401 www.copper.org	(800) 232-3282 (212) 251-7200
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Rd., Suite 419 Chattanooga, TN 37421	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046	(301) 596-2584
CPPA	Corrugated Polyethylene Pipe Association 432 N. Superior St. Toledo, OH 43604	(800) 510-2772 (419) 241-2221
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173-4758 www.crsi.org	(847) 517-1200
CTI	Ceramic Tile Institute of America 12061 West Jefferson Blvd. Culver City, CA 90230-6219	(310) 574-7800
DHI	Door and Hardware Institute (Formerly: National Builders Hardware Association) 14170 Newbrook Dr. Chantilly, VA 20151-2223 www.dhi.org	(703) 222-2010
DIPRA	Ductile Iron Pipe Research Association 245 Riverchase Pkwy East, Suite O Birmingham, AL 35244	(205) 988-9870
DLPA	Decorative Laminate Products Association (Dissolved in 1995 - Now part of KCMA.)	
EIMA	EIFS Industry Members Association 402 N. Fourth St., Suite 102 Yakima, WA 98901-2470 www.eifsfacts.com	(800) 294-3462 (509) 457-3500

EJMA	Expansion Joint Manufacturers Association 25 N. Broadway Tarrytown, NY 10591-3201	(914) 332-0040
FCICA	Floor Covering Installation Contractors Association (Formerly: Floor Covering Installation Board) P.O. Box 948 Dalton, GA 30722-0948	(706) 226-5488
FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System 1151 Boston-Providence Tnpk. P.O. Box 9102 Norwood, MA 02062-9102 www.factorymutual.com	(781) 762-4300
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, DC 20002 www.usg.com	(202) 289-5440
GANA	Glass Association of North America (Formerly: Flat Glass Marketing Association) 3310 SW Harrison St. Topeka, KS 66611-2279 www.glasswebsite.com/gana	(913) 266-7013
GRI	Geosynthetic Research Institute 33rd and Lancaster Walk Rush Building, West Wing Philadelphia, PA 19104 www.gri-server.coe.drexel.edu	(215) 895-2343
HEI	Heat Exchange Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/hei	(216) 241-7333
HMA	Hardwood Manufacturers Association (Formerly: Southern Hardwood Lumber Manufacturers Association) 400 Penn Center Blvd., Suite 530 Pittsburgh, PA 15235-5605 www.hardwood.org	(412) 829-0770
HPVA	Hardwood Plywood and Veneer Association 1825 Michael Farraday Dr. P.O. Box 2789 Reston, VA 22195-0789 www.hpva.org	(703) 435-2900
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 440 South Yarmouth, MA 02664	(508) 394-4424

IEEE	Institute of Electrical and Electronics Engineers 345 E. 47th St. New York, NY 10017-2394 www.ieee.org	(800) 678-4333 (212) 705-7900
IESNA	Illuminating Engineering Society of North America 120 Wall St., 17th Floor New York, NY 10005-4001 www.iesna.org	(212) 248-5000
IIDA	International Interior Design Association 341 Merchandise Mart Chicago, IL 60654-1104	(312) 467-1950
ISS	Iron and Steel Society 410 Commonwealth Dr. Warrendale, PA 15086-7512 www.issource.org	(412) 776-1535
LGSI	Light Gage Structural Institute c/o Loseke Technologies, Inc. P.O. Box 560746 The Colony, TX 75056	(972) 625-4560
LMA	Laminating Materials Association (Formerly: American Laminators Association) 116 Lawrence St. Hillsdale, NJ 07642-2730 www.lma.org	(201) 664-2700
LPI	Lightning Protection Institute 3335 N. Arlington Heights Rd., Suite E Arlington Heights, IL 60004-7700	(800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturer's Association c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/mbma	(216) 241-7333
MCAA	Mechanical Contractors Association of America 1385 Piccard Dr. Rockville, MD 20850-4329	(301) 869-5800
MFMA	Maple Flooring Manufacturers Association 60 Revere Dr., Suite 500 Northbrook, IL 60062 www.maplefloor.com	(847) 480-9138
MFMA	Metal Framing Manufacturers Association (Formerly: Wood and Synthetic Flooring Institute) 401 N. Michigan Ave. Chicago, IL 60611	(312) 644-6610

MHI	Material Handling Institute (A Division of the Material Handling Industry) 8720 Red Oak Blvd., Suite 201 Charlotte, NC 28217-3992 www.mhi.org	(800) 345-1815 (704) 522-8644
MIA	Marble Institute of America 30 Eden Alley, Suite 301 Columbus, OH 43215 www.marble-institute.com	(614) 228-6194
MIA	Masonry Institute of America 2550 Beverly Blvd. Los Angeles, CA 90057 www.masonryinstitute.org	(213) 388-0472
ML/SFA	Metal Lath/Steel Framing Association (A Division of the NAAMM) 8 South Michigan Ave., Suite 1000 Chicago, IL 60603	(312) 456-5590
MRCA	Midwest Roofing Contractors Association 4840 W. 15th St., Suite 1000 Lawrence, KS 66049	(800) 879-4448 (913) 843-4888
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Ave., Suite 1000 Chicago, IL 60603 www.gss.net/naamm	(312) 456-5590
NAMI	National Accreditation & Management Institute, Inc. P.O. Box 366 207 S. Washington St. Berkeley Springs, WV 25411	(304) 258-5100
NAPA	National Asphalt Pavement Association NAPA Building 5100 Forbes Blvd. Lanham, MD 20706-4413	(301) 731-4748
NCAC	National Council of Acoustical Consultants P.O. Box 359 66 Morris Ave., Suite 1A Springfield, NJ 07081	(201) 564-5859
NCMA	National Concrete Masonry Association 2302 Horse Pen Rd. Herndon, VA 20171-3499 www.ncma.org	(703) 713-1900

NCSPA	National Corrugated Steel Pipe Association 1255 23rd St., NW, Suite 850 Washington, DC 20037 www.ncspa.org	(202) 452-1700
NEBB	Natural Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877-4121	(301) 977-3698
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814-5372	(301) 657-3110
NEI	National Elevator Industry 185 Bridge Plaza North, Suite 310 Fort Lee, NJ 07024	(201) 944-3211
NELMA	Northeastern Lumber Manufacturers Association 272 Tuttle Rd. P.O. Box 87A Cumberland Center, ME 04021	(207) 829-6901
NEMA	National Electrical Manufacturers Association 1300 N 17th St., Suite 1847 Rosslyn, VA 22209 www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association P.O. Box 687 106 Stone St. Morrison, CO 80465-1526 www.electricnet.com/neta	(303) 697-8441
NHLA	National Hardwood Lumber Association P.O. Box 34518 Memphis, TN 38184-0518 www.natlhardwood.org	(901) 377-1818
NIA	National Insulation Association (Formerly: National Insulation and Abatement Contractors Association) 99 Canal Center Plaza, Suite 222 Alexandria, VA 22314 www.insulation.org	(703) 683-6422
NLGA	National Lumber Grades Authority #406-First Capital Pl., 960 Quayside Dr. New Westminster, BC V3M 6G2	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association P.O. Box 3009 Memphis, TN 38173-0009	(901) 526-5016

NPA	National Particleboard Association 18928 Premiere Ct. Gaithersburg, MD 20879-1569 www.pbmdf.com	(301) 670-0604
NPCA	National Paint and Coatings Association 1500 Rhode Island Ave., NW Washington, DC 20005-5597 www.paint.org	(202) 462-6272
NRCA	National Roofing Contractors Association O'Hare International Center 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018-5607 www.roofonline.org	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association 900 Spring St. Silver Spring, MD 20910 www.nrmca.org	(301) 587-1400
NSA	National Stone Association 1415 Elliot Pl., NW Washington, DC 20007 www.aggregates.org	(202) 342-1100
NSF	NSF International (Formerly: National Sanitation Foundation) P.O. Box 130140 Ann Arbor, MI 48113-0140 www.nsf.org	(313) 769-8010
NSSEA	National School Supply and Equipment Association 8300 Colesville Rd., Suite 250 Silver Spring, MD 20910	(800) 395-5550 (301) 495-0240
NTMA	National Terrazzo and Mosaic Association 3166 Des Plaines Ave., Suite 121 Des Plaines, IL 60018 www.ntma.com	(800) 323-9736 (847) 635-7744
NWWDA	National Wood Window and Door Association (Formerly: National Woodwork Manufacturers Association) 1400 E. Touhy Ave., G-54 Des Plaines, IL 60018 www.nwwda.org	(800) 223-2301 (847) 299-5200
PCA	Portland Cement Association 5420 Old Orchard Rd. Skokie, IL 60077-1083 www.portcement.org	(847) 966-6200

PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604 www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America 3913 Old Lee Hwy, Suite 33-B Fairfax, VA 22030 www.pdca.com	(800) 332-7322 (703)359-0826
PDI	Plumbing and Drainage Institute 45 Bristol Dr., Suite 101 South Easton, MA 02375	(800) 589-8956 (508) 230-3516
PPFA	Plastic Pipe and Fittings Association 800 Roosevelt Rd., Building C, Suite 20 Glen Ellyn, IL 60137-5833	(630) 858-6540
PPI	Plastic Pipe Institute (The Society of the Plastics Industry, Inc.) 1801 K St., NW, Suite 600L Washington, DC 20006 www.plasticpipe.org	(202) 974-5306
RCSC	Research Council on Structural Connections Sargent & Lundy 55 E. Monroe St. Chicago, IL 60603	(312) 269-2424
RFCI	Resilient Floor Covering Institute 966 Hungerford Dr., Suite 12-B Rockville, MD 20850-1714	(301) 340-8580
RMA	Rubber Manufacturers Association 1400 K St., NW, Suite 900 Washington, DC 20005 www.rma.org	(800) 220-7620 (202) 682-4800
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org	(847) 462-1930
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145-1967	(216) 889-0010
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave. Chicago, IL 60611-4267	(312) 644-6610
SJI	Steel Joist Institute 3127 10th Ave., North Ext. Myrtle Beach, SC 29577-6760	(803) 626-1995

SMACNA	Sheet Metal and Air Conditioning Contractors' National Association, Inc. 4201 Lafayette Center Dr. P.O. Box 221230 Chantilly, VA 20151-1209 www.smacna.org	(703) 803-2980
SPI	Society of the Plastics Industry, Inc. Spray Polyurethane Division 1801 K St., NW, Suite 600K Washington, DC 20006 www.socplas.org	(800) 951-2001 (202)974-5200
SPRI	SPRI (Formerly: Single Ply Roofing Institute) 175 Highland Ave. Needham Heights, MA 02194-3034	(617) 444-0242
SSINA	Specialty Steel Industry of North America c/o Collier, Shannon Rill & Scott 3050 K St., NW, Suite 400 Washington, DC 20007 www.ssina.com	(800) 982-0355 (202)342-8630
SSPC	Steel Structures Painting Council 40 24th St., 6th Floor Pittsburgh, PA 15222-4643	(412) 281-2331
SWRI	Sealant, Waterproofing and Restoration Institute 2841 Main Kansas City, MO 64108	(816) 472-7974
TCA	Tile Council of America 100 Clemson Research Blvd. Anderson, SC 29625	(864) 646-8453
TPI	Truss Plate Institute (Formerly: American Sod Producers Association) 583 D'Onofrio Dr., Suite 200 Madison, WI 53719	(608) 833-5900
TPI	Turfgrass Producers International (Formerly: American Sod Producers Association) 1855-A Hicks Rd. Rolling Meadows, IL 60008	(800) 405-8873 (847) 705-9898
UL	Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062 www.ul.com	(800) 704-4050 (847) 272-8800
WA	Wallcoverings Association 401 N. Michigan Ave. Chicago, IL 60611-4267	(312) 644-6610
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281-3145	(503) 639-0651

WCMA	Window Covering Manufacturers Association (Formerly: American Window Covering Manufacturers Association) 355 Lexington Ave., 17th Floor New York, NY 10017-6603	(212) 661-4261
WEF	Water Environment Federation (Formerly: Water Pollution Control Federation) 601 Wythe St. Alexandria, VA 22314-1994	(703) 684-2400
WIC	Woodwork Institute of California P.O. Box 980247 West Sacramento, CA 95798-0247	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association 507 First St. Woodland, CA 95695 www.wmmpa.com	(800) 550-7889 (916) 661-9591
WPCF	Water Pollution Control Federation (See WEF)	
WRI	Wire Reinforcement Institute 203 Loudoun St., SW Leesburg, VA 20175-2718	(703) 779-2339
WSC	Water Systems Council Building C, Suite 20 800 Roosevelt Rd. Glen Ellyn, IL 60137	(630) 545-1762
WSFI	Wood and Synthetic Flooring Institute (See MFMA)	
WWPA	Western Wood Products Association Yeon Building 522 SW 5th Ave. Portland, OR 97204-2122	(503) 224-3930
CE	Corps of Engineers (U.S. Department of the Army) 20 Massachusetts Ave., NW Washington, DC 20314 CRD standards are available from: U.S. Army Corps of Engineers Waterways Experiment Station Technical Report Distribution Section Services Branch, TIC 3909 Halls Ferry Rd. Vicksburg, MS 39180-6199	(202) 761-0660 (601) 634-2696
CFR	Code of Federal Regulations (Available from the Government Printing Office) Washington, DC 20401 (Material is usually published first in the "Federal Register.") www.access.gpo.gov	(202) 512-0000

CPSC	Consumer Product Safety Commission East West Towers 4330 East-West Hwy Bethesda, MD 20814	(800) 638-2772
CS	Commercial Standard (U.S. Department of Commerce) Government Printing Office Washington, DC 20402 For Commercial standards, contact: Ms. Brenda Umberger CS & PS Specialist c/o NIST Gaithersburg, MD 20899	(202) 512-1800 (301) 975-4036
DOC	Department of Commerce 14th St. and Constitution Ave., NW Washington, DC 20230	(202) 482-2000
DOT	Department of Transportation 400 Seventh St., SW Washington, DC 20590	(202) 366-4000
EPA	Environmental Protection Agency 401 M St., SW Washington, DC 20460	(202) 260-2090
FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Ave., SW Washington, DC 20591	(202) 366-4000
FCC	Federal Communications Commission 1919 M St., NW Washington, DC 20554	(202) 418-0126
FDA	Food and Drug Administration 5600 Fishers Lane Rockville, MD 20857	(301) 443-1544
FHA	Federal Housing Administration (U.S. Department of Housing and Urban Development) 451 Seventh St., SW Washington, DC 20410	(202) 401-0388
FS	Federal Specification Unit (Available from GSA) 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407	(202) 619-8925
GSA	General Services Administration F St. and 18th St., NW Washington, DC 20405	(202) 708-5082

MIL	Military Standardization Documents (U.S. Department of Defense) Defense Printing Service 700 Robbins Ave., Building 4D Philadelphia, PA 19111	(215) 697-2179
NIST	National Institute of Standards and Technology (U.S. Department of Commerce) Building 101, #A1134, Rte. I-270 and Quince Orchard Rd. Gaithersburg, MD 20899	(301) 975-2000
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) 200 Constitution Ave., NW Washington, DC 20210	(202) 219-8148
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, DC 20402 For Product standards, contact: Ms. Brenda Umberger CS & PS Specialist c/o NIST Gaithersburg, MD 20899	(202) 512-1800 (301) 975-4036
RUS	Rural Utilities Service (Formerly: Rural Electrification Administration) (U.S. Department of Agriculture) 14th St. and Independence Ave., SW Washington, DC 20250	(202) 720-9560
TRB	Transportation Research Board, National Research Council 2101 Constitution Ave., NW Washington, DC 20418	(202) 334-2934
USDA	U.S. Department of Agriculture 14th St. and Independence Ave., SW Washington, DC 20250	(202) 720-8732
USPS	U.S. Postal Service 475 L'Enfant Plaza, SW Washington, DC 20260-0010	(202) 268-2000

1.5 SUBMITTALS

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 4500

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

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.

1.2 RELATED SECTIONS

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

B. Related Sections:
   1. Division 1 Section "Cutting and Patching" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.
   2. Division 1 Section "Submittals" specifies requirements for development of a schedule of required tests and inspections.

1.3 RESPONSIBILITIES

A. Owner Responsibilities: Owner will provide soils, concrete, and structural testing. The contractor is responsible for coordination of services.

B. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
   1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.

C. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of 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.

D. 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.

E. 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.
   4. The agency shall send copies of concrete test reports to the structural engineer, contractor, and Owner, as well as the Architect. Copies of the concrete test reports should be faxed to the structural engineer. Structural engineers should review concrete test reports since they, in most cases, furnish the specifications.

F. 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.

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

1.5 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 are 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.

1.6 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.

PART 2 PRODUCTS – NOT USED

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

SECTION 01 4520 (**OWNER PAYS)**

STRUCTURAL TESTING/INSPECTION AGENCY SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section summarizes the responsibility of the Contractor and the Structural Testing/Inspection Agency in the performance of the testing/inspection specified in the Contract Documents.

B. Neither the observation of the Architect/Structural Engineer in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by persons other than the Architect/Structural Engineer shall relieve the Contractor from his obligation to perform the work in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittals.

1.3 REFERENCES

A. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

C. American Council of Independent Laboratories - Recommended Requirements for Independent Laboratories Qualifications.

1.4 SELECTION AND PAYMENT

A. Owner will employ and pay for the structural testing/inspection services that are required by the Contract Documents.

B. Contractor shall pay for any additional structural testing/inspection required for work or materials not complying with Contract Documents due to negligence or nonconformance.

C. Contractor shall pay for any additional structural testing/inspection required for his convenience.

1.5 STRUCTURAL TESTING/INSPECTION REQUIREMENT SUMMARY

A. Specific structural testing/inspection requirements are given in the following specifications:

Specification 03200 - Concrete Reinforcement Inspection
Specification 03300 - Concrete Testing/Inspection
Specification 04220 - Structural Concrete Masonry Testing/Inspection
Specification 05120 - Structural Steel Testing/Inspection
Specification 05210 - Steel Joists Testing/Inspection

B. Inspection of all field welding operations, including the installation of automatic end-welded stud shear connectors, shall be made by qualified welding inspectors approved by the local building authority. Such inspectors shall be persons trained and thoroughly experienced in

inspecting welding operations. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in the provisions of the 1992 edition of AWS QCI, Standard and Guide for Qualification and Certification of Welding Inspectors published by the American Welding Society. Inspectors performing nondestructive testing shall be qualified in accordance with the American Society of Nondestructive Testing, Inc.

PART 2 MATERIALS

Not Used.

PART 3 EXECUTION

3.1 STRUCTURAL PRECONSTRUCTION MEETING

A. A structural preconstruction meeting may be conducted at the construction site by the Structural Engineer to discuss quality issues. The parties involved may be the Architect, Contractor, Structural Testing/Inspection Agency, appropriate subcontractors, suppliers, and detailers.

3.2 STRUCTURAL TESTING/INSPECTION AGENCY'S RESPONSIBILITIES

A. Cooperate with the Contractor and provide timely service.

B. Upon arriving at the construction site, sign in and notify the Contractor of presence.

C. Select the representative samples that are to be tested/inspected.

D. Perform tests/inspections as outlined in Contract Documents, the applicable codes, and as directed by the Structural Engineer.

E. Report work and materials not complying with Contract Documents immediately to the Contractor and Structural Engineer.

F. Leave copies of field notes with the Contractor prior to leaving the construction site. Field notes shall include the message given to the Contractor, date, time of message, name of Contractor's representative informed, type and location of work or materials tested/inspected, whether the work or materials complies with Contract Documents and name of the Structural Testing/Inspection Agency's representative.

G. Report and distribute results of tests/inspections promptly in the form of written reports as directed by the Structural Engineer.

H. Structural Testing/Inspection Agency shall not alter requirements of Contract Documents, approve or reject any portion of the work, or perform duties of the Contractor.

I. Submit written confirmation at end of construction that, to the best of their knowledge, the structural work conforms to the Contract Documents.

3.3 CONTRACTOR'S RESPONSIBILITIES

A. Provide copy of Contract Documents to the Structural Testing/Inspection Agency.

B. Arrange the preconstruction meeting to discuss quality issues.

C. Notify the Structural Testing/Inspection Agency sufficiently in advance of operations to allow assignment of personnel and scheduling of tests.

D. Cooperate with Structural Testing/Inspection Agency and provide access to work.

E. Provide samples of materials to be tested in required quantities.

F. Furnish copies of mill test reports when requested.

G. Provide storage space for Structural Testing/Inspection Agency's exclusive use, such as for storing and curing concrete testing samples.

H. Provide labor to assist the Structural Testing/Inspection Agency in performing tests/inspections.

3.4 OPTIONS

A. If the Structural Testing/Inspection Agency is located at such a distance from the project that travel expenses will be a consideration, or if the amount of sampling performed is minor, and by mutual agreement of the Architect/Structural Engineer and Contractor, the Contractor may be requested to take samples and forward them to the Structural Testing/Inspection Agency for testing/inspection.

END OF SECTION

SECTION 01 5000

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 – GENERAL

1.2 SECTION INCLUDES

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. 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. Sidewalk bridge or enclosure fence for the site.
   4. Environmental protection.

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.4 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. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist 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. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

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. Install telephone on a separate line for each temporary office and first-aid station.
   1. Separate Telephone Lines: Provide additional telephone lines for the following:
      a. Where an office has more than 2 occupants, install a telephone for each additional occupant or pair of occupants.
      b. Provide a dedicated telephone line for a fax machine in the field office.
   2. At each telephone, post a list of important telephone numbers.

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. 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.

J. 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.

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

3.3 SUPPORT FACILITIES INSTALLATION

A. 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. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet of building lines. Comply with requirements of NFPA 241.

C. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
   1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
   2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.

D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.

E. 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.

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

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

H. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
   1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated. Install 14 days after Notice to Proceed.
   2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
   3. See attached sign layout.

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

J. 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.

K. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

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, but not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. 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.

F. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.

G. Provide plywood fence, 8 feet high, framed with four 2-by-4-inch rails, and preservative-treated wood posts spaced not more than 8 feet apart.

H. Fencing use may be waved by owner.

I. 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.

J. 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.

K. 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, ven tilation, 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.

D. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

E. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.

F. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

G. Replace air filters and clean inside of ductwork and housings.

H. Replace significantly worn parts and parts subject to unusual operating conditions.

I. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION

SECTION 01 6200

SUBSTITUTIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
   2. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.
   3. Division 1 Section "Materials and Equipment" specifies requirements governing the Contractor's selection of products and product options.

1.3 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
   1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
   2. Revisions to the Contract Documents requested by the Owner or Architect.
   3. Specified options of products and construction methods included in the Contract Documents.
   4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 30 days after award of the project. Requests received more than 30 days after commencement of the work may be rejected at the discretion of the Architect.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
   2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
   3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
      a. Coordination information, including a list of changes or modifications needed to other parts of the work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.

b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
d. Samples, where applicable or requested.
e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
f. Cost information, including a proposal of the net change, if any in the Contract Sum.
g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in written form.
   a. Use the product specified if the Architect does not accept the proposed substitute.

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
   1. Extensive revisions to the Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of the Contract Documents.
   3. The request is timely, fully documented, and properly submitted.
   4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
   5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
   6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
   7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
   8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
   9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.

10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
11. Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

C. Substitution form: See attached

PART 3 EXECUTION

"OR EQUAL" SUBSTITUTION SR #: _____

TO: _____

PROJECT: _____

SPECIFIED ITEM: _____

_____	_____	_____	_____
Section	Page	Paragraph	Description

The undersigned requests consideration of the following:

PROPOSED "OR EQUAL" SUBSTITUTION

Attached data includes product data and description, specifications, shop drawings, photographs, certified performance and test results adequate for evaluation of the request; applicable portions of the data are clearly identified.
Attached data also includes a description of changes to the Contract Documents which the proposed substitution or "or equal" will require for its proper installation. Acceptance of the proposed "or equal" substitution will require the following changes: _____

_____

The undersigned certifies that the following paragraphs, unless modified by attachments are correct: _____

1. The proposed "or equal" substitution does not affect dimensions shown on the drawings.
2. The undersigned will coordinate the installation of the proposed product and will make changes to other Work which may be required at no additional costs to the Owner.
3. The proposed "or equal" substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed "or equal" substitution.
5. The proposed product has been investigated and it has been determined that the function, appearance and quality of the proposed substitution are equivalent or superior to the specified item.
6. The same warranty is available for the proposed product as for the specified product.
7. Any claim for additional costs and/or time in connection with the proposed "or equal" substitution are hereby waived.
8. The Owner will be reimbursed for review or redesign services associated with re-approval by authorities.
8. Incorporation or use of the proposed "or equal" substitution in the Work ____ is _____ or is not subject to payment of any license fee or royalty.

The undersigned agrees to pay all costs that result directly or indirectly from acceptance of such "or equal" substitute, including costs of redesign and claims of other contractors affected by the resulting change.

Submitted by: _____

Signature: _____

Firm: _____

Address: _____

Date: _____

Telephone: _____

Attachments: _____

_____

_____

For use by the design consultant:

_____ Accepted _____ Accepted as noted

_____ Not Accepted _____ Received too late

By: _____

Date: _____

Remarks: _____

END OF SECTION

SECTION 01 6250

STARTING OF SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting, and balancing.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Manufacturers field reports.

B. Section 01700 - Contract Closeout: System operation and maintenance data and extra materials.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Starting of systems shall not alter effective beginning of warranty dates specified herein.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.5 TESTING, ADJUSTING, AND BALANCING

A. Contractor will appoint, employ, and pay for services of an independent firm to perform testing, adjusting and balancing.

B. Owner will approve of an independent firm to perform testing, adjusting and balancing. Contractor shall pay for services as specified in Division 23.

C. Reports will be submitted by the independent firm to the Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 6505

MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General 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 "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
   2. Division 1 Section "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
   3. 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 SUBMITTALS

A. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.
   1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
   2. Form: Prepare product list with information on each item tabulated under the following column headings:
      a. Related Specification Section number.
      b. Generic name used in Contract Documents.
      c. Proprietary name, model number, and similar designations.
      d. Manufacturer's name and address.
      e. Supplier's name and address.
      f. Installer's name and address.

g. Projected delivery date or time span of delivery period.

3. Initial Submittal: Within 30 days after date of commencement of the work, submit 3 copies of an initial product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.
4. Completed List: Within 60 days after date of commencement of the work, submit 3 copies of the completed product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.
5. Architect's Action: The Architect will respond in writing to Contractor within 2 weeks of receipt of the completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.5 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. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers 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.

1.6 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 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.

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 permit-ted.
   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.
9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections.

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

SECTION 01 7123

FIELD ENGINEERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General 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. Damage surveys.

B. Related Sections:
   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. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of "Submittals" and "Project Closeout" Sections.

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.

B. Engineer Qualifications: Engage an engineer of the discipline required, licensed in the state where the Project is located, to perform required engineering services.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Identification: The Owner’s survey 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 site work, 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.

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.

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.

END OF SECTION

SECTION 01 7329

CUTTING AND PATCHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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 23 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 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. Timber and primary wood framing.
      g. Structural decking.
      h. Stair systems.
      i. Miscellaneous structural metals.
      j. Exterior curtain-wall construction.
      k. Equipment supports.
      l. Piping, ductwork, vessels, and equipment.
      m. 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. Conveying systems.
j. Electrical wiring systems.
k. Operating systems of special construction in Division 13 Sections.

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. If possible 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. Processed concrete finishes.
b. Ornamental metal.
c. Matched-veneer woodwork.
d. Firestopping.
e. Exterior finish system
f. Window wall system.
g. Acoustical ceilings.
h. Finished wood flooring.
i. Carpeting.
j. Wall covering.
k. HVAC enclosures, cabinets, or covers.

1.4 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.
   3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      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.
   4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

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

SECTION 01 7700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Operation and Maintenance Data - Division One

C. Warranties

1.2 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 02 through 33.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before submitting a request for substantial completion inspection, complete the following.
   1. Advise the Owner of pending insurance changeover requirements.
   2. 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.
   3. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
   4. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel.
   5. Submit a comprehensive list of items completed or corrected by the contractor.

B. Inspection Procedures: On receipt of a Request for Substantial Completion Inspection, the Architect will do one of the following:
   1. Proceed with the inspection and prepare a Certificate of Substantial Completion following inspection.
   2. If it is apparent that the project is not substantially complete, the inspection will cease. The contractor will be advised of unfulfilled requirements. The contractor will be notified of construction that must be completed or corrected before the certificate will be issued. The Architect will repeat inspection when requested and assured that the work is substantially complete.
   3. Results of the completed inspection (preliminary punch list) will form the basis of requirements for final acceptance following issuance of the Certificate of Substantial Completion.

C. Submit pay application in accordance with General Conditions.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before submitting the Request for Final Inspection, complete the following.
   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 record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
   3. Deliver tools, spare parts, extra stock, and similar items.
   4. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
   5. Complete final cleanup requirements, including touch up painting.
   6. Touch up and otherwise repair and restore marred, exposed finishes.
   7. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
   8. Execute Certificate of Substantial Completion.
   9. Complete or correct all items identified at or since substantial completion. Submit a copy of the list stating that each item has been completed indicating date completed and installed.
   10. Submit Guarantee of Work as per General Conditions 12.2.2.5.
   11. Submit reconciliation of allowances for inclusion in final change order.

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. 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.

C. Final Procedures:
   1. Execute Certificate of Final Completion.
   2. Submit final payment request.
   3. Submit Consent of Surety to Final Payment.
   4. Submit Release of Liens (AIA Document G706A).

1.5 RECORD DOCUMENT SUBMITTAL

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. 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.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. 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. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
1. Mark these documents to show significant variations in actual work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittal: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittal 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.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 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.
8. Fixture lamping schedule.

PART 2 PRODUCTS - NOT USED

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. Fuels.
7. Identification systems.

8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. 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.

3.2 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division Section "Construction Facilities and Temporary Controls."

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Final Completion.
a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even textured surface.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

F. Where extra materials of value remain after completion of associated work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION

Request for Substantial Completion Inspection

Date

Project Name

Project Number

Contractor

Certified by

Request for Final Completion Inspection

Date
Project Name
Project Number
Contractor

Certified by_____

SECTION 01 7823

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. his 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.

1.3 QUALITY ASSURANCE

A. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.
   1. 1.Where maintenance manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.
   2. Where maintenance manuals require drawings or diagrams, use draftsmen capable of preparing drawings clearly in an understandable format.

B. Instructions for the Owner's Personnel: Use experienced instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved to instruct the Owner's operation and maintenance personnel.

1.4 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:
   1. Before Substantial Completion, when each installation that requires operation and maintenance manuals is nominally complete, submit 2 draft copies of each manual to the Architect for review. Include a complete index or table of contents of each manual.
      a. The Architect will return 1 copy of the draft with comments within 15 days of receipt.
   2. 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.

3. 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, in thickness necessary to accommodate contents, sized to receive 8-1/2-by-11- inch paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.
      a. Where 2 or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
      b. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered.
   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, 20-lb/sq. ft. 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.

1.5 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. 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.
   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.

1.6 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

A. Submit 6 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. Schedule: Provide complete information in the equipment and systems manual on products specified in the following Sections:
   1. Divisions 15000 and 16000.

1.7 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. For equipment that requires seasonal operation, provide similar instruction during other seasons.
   2. 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 USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 7830

WARRANTIES

PART 1 – GENERAL

1.2 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer 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 33 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.

1.3 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.

1.4 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.

1.5 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Final 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.
   On advice of the Owner's legal counsel, revise subparagraph below, particularly in the event of partial occupancy. Sometimes extended warranties may be necessary.
   1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the work.

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.

C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
   1. Refer to Divisions 2 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

D. 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 based on the table of contents of the Project Manual.

E. 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 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 USED

PART 3 – EXECUTION

3.1 LIST OF WARRANTIES

A. Schedule: Provide warranties on products and installations as specified in each Section.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Building frame members.

B. Related Sections:
   1. DIVISION 21- SITEWORK
   2. DIVISION 5- METALS
   3. DIVISION 23- MECHANICAL
   4. DIVISION 26- ELECTRICAL

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, slag cement and silica fume; subject to compliance with requirements.

B. Qualified Lab: Laboratory that performs acceptance testing complying with the requirements of ASTM C1077. Test results shall be certified by an engineer licensed in the state where the project is being constructed.

C. Laboratory developing test data for project submittals complying with the requirements for ASTM C1077, with the exception of the requirement of being under the direction of a PE.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: Submit field or laboratory test records used to document that proposed mixture will achieve the required average compressive strength and other specified requirements in Section 2.16 for each class of concrete.
   1. When project conditions, weather, test results, or other circumstances warrant adjustment to the mixture, submit field or laboratory test records to document that the adjusted mixture will achieve the required average compressive strength and other specified requirements. Adjustments to chemical admixture dosage rates to maintain air content, set time and workability levels do not require additional testing.
   2. Submit list of ingredients used for the composition of design mixtures.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Aggregates
   3. Admixtures.
   4. Mixing water- for non-potable sources of water, documented conformance to mandatory requirements of ASTM C1602.
   5. Form materials and form-release agents.
   6. Steel reinforcement and accessories.
   7. Curing compounds.
   8. Floor and slab treatments.
   9. Bonding agents.
   10. Adhesives.
   11. Vapor retarders.
   12. Semirigid joint filler.
   13. Joint-filler strips.
   14. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements as required for structural members in 2.16.
   1. Freeze-thaw durability in accordance with ASTM C457 or ASTM C666.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Employs project personnel on the finishing crew qualified as ACI Flatwork Finisher, Technician, or equivalent. The supervisor shall be certified as an ACI Concrete Flatwork Finisher, or equivalent.
   2. When requested, the installer shall furnish a Quality Control Plan.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" or State DOT.
   2. Submit quality control plan for production of ready-mixed concrete.
   3. Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2, State DOT certification, or equivalent. Requirement waived if individual is a licensed professional engineer in the jurisdiction of the Work.

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing

Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

3. Test results used for acceptance of concrete shall be certified by a licensed engineer employed with the Testing Agency.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: When the manufacturer does not comply with 1.6.B.3 engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures. The manufacturer is permitted to engage a qualified independent testing agency to perform specific tests for project submittals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch ~~(19 by 19 mm~~), minimum.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 deformed bars, assembled with clips.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60~~,~~ plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials:
   1. Portland Cement: Unless otherwise noted for specific structural member in 2.16, use ASTM C 150, Type I or Type II gray or white.
   2. Blended Hydraulic Cement: ASTM C 595. Unless otherwise noted for specific structural member in 2.16, use Type IS, portland blast-furnace slag Type IP, portland-pozzolan.
   3. Performance Cement: ASTM C 1157, Unless otherwise noted for specific structural member in 2.16, use Type GU- general use.

4. Supplementary Cementious materials. Unless otherwise noted for specific structural member in 2.16, use:
   a. Fly Ash, natural pozzolan or metakaolin: ASTM C618, Class C, F or N.
   b. Slag cement: ASTM C989, Grade 100.
   c. Silica Fume: ASTM C1240

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source[with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials].
   1. Nominal Maximum Coarse-Aggregate Size: As defined for each structural member in 2.16.
   2. Fine Aggregate: Use normal weight fine aggregates that conform to ASTM C33.

C. Water: ASTM C 1602.
   1. For non-potable sources of water, submit documentation on the acceptability of water used in mixing water in concrete in accordance with the mandatory requirements of ASTM C1602.
   2. For non-potable sources of water, provided documentation for these characteristics in accordance with the optional limits of ASTM C1602: Chloride as CI less than 1000 ppm.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Permit chemical admixtures listed below:
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Accelerating Admixtures, ASTM C494/C494M Type C, Type E.
   4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
   8. Admixtures for corrosion inhibition: ASTM C1582

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
      b. Fortifiber Building Systems Group; Moistop Ultra 10.
      c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
      d. Insulation Solutions, Inc.; Viper VaporCheck 10.
      e. Meadows, W. R., Inc.; Perminator 10 mil.
      f. Raven Industries Inc.; Vapor Block 10.
      g. Reef Industries, Inc.; Griffolyn 10 mil Green.
      h. Stego Industries, LLC; Stego Wrap 10 mil Class A.

B. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fortifiber Building Systems Group; Moistop Ultra 6.
      b. Reef Industries, Inc.; Griffolyn 10 mil Green.

c. Stego Industries, LLC; Stego Wrap, 10 mil Class A.

C. Sheet Vapor Retarder: ASTM E 1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
1. Products: Subject to compliance with requirements, provide the following [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
a. Fortifiber Building Systems Group; Moistop Plus.
b. Raven Industries Inc.; Vapor Block 6.
c. Reef Industries, Inc.; Griffolyn Type-65.
d. Stego Industries, LLC; Stego Wrap, 10 mil Class C.

D. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

E. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

F. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
b. BASF Construction Chemicals - Building Systems; Confilm.
c. ChemMasters; SprayFilm.
d. Conspec by Dayton Superior; Aquafilm.
e. Dayton Superior Corporation; Sure Film (J-74).
f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; Vapor-Aid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. BASF Construction Chemicals - Building Systems; Kure 200.
      c. ChemMasters; Safe-Cure Clear.
      d. Conspec by Dayton Superior; W.B. Resin Cure.
      e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      f. Edoco by Dayton Superior; Res X Cure WB.
      g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      h. Kaufman Products, Inc.; Thinfilm 420.
      i. Lambert Corporation; AQUA KURE - CLEAR.
      j. L&M Construction Chemicals, Inc.; L&M Cure R.
      k. Meadows, W. R., Inc.; 1100-CLEAR.
      l. Nox-Crete Products Group; Resin Cure E.
      m. Right Pointe; Clear Water Resin.
      n. SpecChem, LLC; Spec Rez Clear.
      o. Symons by Dayton Superior; Resi-Chem Clear.
      p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
      q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Construction Chemicals - Building Systems; Kure-N-Seal 25 LV.
      b. ChemMasters; Spray-Cure & Seal Plus.
      c. Conspec by Dayton Superior; Sealcure 1315.
      d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
      e. Edoco by Dayton Superior; Cureseal 1315.
      f. Euclid Chemical Company (The), an RPM company; Super Diamond Clear; LusterSeal 300.
      g. Kaufman Products, Inc.; Sure Cure 25.
      h. Lambert Corporation; UV Super Seal.
      i. L&M Construction Chemicals, Inc.; Lumiseal Plus.
      j. Meadows, W. R., Inc.; CS-309/30.
      k. Metalcrete Industries; Seal N Kure 30.
      l. Right Pointe; Right Sheen 30.
      m. Vexcon Chemicals, Inc.; Certi-Vex AC 1315.
   2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Construction Chemicals - Building Systems; Kure 1315.
      b. ChemMasters; Polyseal WB.
      c. Conspec by Dayton Superior; Sealcure 1315 WB.
      d. Edoco by Dayton Superior; Cureseal 1315 WB.
      e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
      f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
      g. Lambert Corporation; UV Safe Seal.
      h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
      i. Meadows, W. R., Inc.; Vocomp-30.

j. Metalcrete Industries; Metcure 30.
k. Right Pointe; Right Sheen WB30.
l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures. Use qualified testing agency to develop supplementary performance test data for additional requirements identified in this specification.

B. Cementitious Materials: Unless otherwise indicated in 2.16 for structural members use any cementitious materials listed in 2.5. Limit percentage, by weight, of cementitious materials other than portland cement in concrete in structural members assigned with exposure class F3 in 2.16 as follows:
   1. Fly Ash: 25 percent.
   2. Combined Fly Ash, metakaolin and Pozzolan: 25 percent.
   3. Slag cement: 50 percent.
   4. Silica Fume: 10 percent.
   5. Combined Fly Ash, metakaolin or Pozzolans Slag Cement, and Silica Fume: 50 percent with fly ash, metakaolin or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to the following limits depending on the exposure category assigned to the structural member identified in 2.16. The limits are stated in terms of chloride ions in percent weight of cement.
   1. Reinforced in Exposure Category C0- 1.00%
   2. Reinforced in Exposure Category C1- 0.30%
   3. Reinforced in Exposure Cateogory C2- 0.15%
   4. Provide documentation from concrete tested in accordance with ASTM C 1218 at an age between 28 and 42 days.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use[water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

E. Air Content: Provide total air content for each class of concrete based on the nominal maximum size of aggregate and the assigned exposure class for resistance to freezing and thawing indicated in 2.16 Concrete for members categories as Exposure Category F0 should be non-air entrained.

Nominal maximum Aggregate size, in	Total Air Content %	
	Exposure Class F2 and F3	Exposure Class F1
3/8”	7.5	6.0
½”	7.0	5.5
¾”	6.0	5.0
1”	6.0	4.5
1 ½”	5.5	4.5
2”	5.0	4.0
3”	4.5	3.5

F. Slump: Provide documentation in submittal prior to commencement of Work to target slump or slump flow value for each class of concrete. Consistency of concrete shall be established to facilitate placement with minimized potential for segregation.

2.12 CONCRETE MIXTURES FOR BUILDING MEMBERS

A. Assign exposure classes from ACI 318 Exposure Categories: F for freezing and thawing; S for exposure to water soluble sulfates in soil; P for concrete members in contact with water requiring low permeability; C for concrete members requiring protection from corrosion of reinforcement. Review the definitions of Exposure Categories and requirements for concrete in ACI 318.
   1. Durability Exposure Classes:
      a. For Exposure to freezing and thawing: F0 or F1.
      b. For Exposure to sulfates: S0.
      c. For contact with water requiring low permeability: P0.
      d. For corrosion protection for reinforcement: C0, C1, C2.

B. Select strength from options below or revise to suit Project. Specified strength should be the more restrictive required for structural design or durability based on assigned exposure class. Coordinate compressive strength with water-cementitious material ratio if concrete will be subject to Exposure Categories defined in ACI 318.
   1. Specified Compressive Strength: 4500 psi, 3000 psi. Specified at 28 days.

C. Select water-cementitious materials ratio from 3 options in subparagraph below, revise to suit Project; if in-service durability conditions are not applicable to the structural member and limits on water-cementitious materials ratio are not required, do not specify w/cm. Select the lowest w/cm as required for the durability Exposure Class defined. Coordinate water-cementitious materials ratio with compressive strength. See Evaluations for discussion.
   1. Maximum Water-Cementitious Materials Ratio: 0.40 Exposure Class C2. Instead of w/cm, specify chloride permeability in Additional Requirements.

D. Select nominal maximum size of aggregate as the smallest based on (1) 1/5 narrowest dimension between sides of forms, (2) 1/3 depth of slabs or (3) ¾ minimum clear spacing between reinforcement.

E. Select air content based on the exposure classification and the nominal maximum size of aggregate- see notes to 2.15.F. For hard-trowel finished slabs, specify that the air content should not exceed 3.0%.
   1. Air content should be based on the Exposure Class established for freeze thaw resistance and nominal maximum aggregate size defined in 2.15.F.
   2. Air Content: In accordance with 2.15.F for the Exposure Class for Category F defined in 2.16.A.1.

F. The required slump of slump flow rate (for SCC) of concete will be selected by the contractor and notified to the Architect/Engineer.
   1. Slump or slump flow: Shall be selected by the contractor and communicated to the concrete supplier to satisfy placement requirements and to minimize segregation. The selected slump or slump flow for this class of concrete shall be notified to the Architect/Engineer. Slump or slump flow during delivery shall be at the level documented with applicable tolerances in ASTM C94.

G. Select water soluble chloride limits based on Exposure Class C1, C2 or C3 as addressed in 2.15.C.

H. Select temperature limit and revise to suit Project. Consider option of submitting a thermal control plan in lieu of limits on temperature of concrete.
   1. Temperature:
      a. Concrete temperature as delivered shall not exceed 95F.
      b. In cold weather, concrete temperature as delivered shall not be less than 55F for section size < 12 in. 50F for 12-36 in 45F for 36-72 in 40F for > 72 p

MEMBER	MIX ID	DURABILITY EXPOSURE F	S	P	C	Specified Strength, f'c psi	Max w/.cm	Nom. Max aggregate	Air content	Slump/slump flow	Chloride limit	Temp. limit
Footings		F0	S0	P0	C1	3000	N.R.	1"	N.R.	ASTM C94	0.30%	55F-95F
Foundation Walls		F0	S0	P0	C1	3000	N.R.	1"	N.R.	ASTM C94	0.30%	55F-95F
Slabs-on-grade		F0	S0	P0	C0	3000	N.R.	1"	N.R.	ASTM C94	1.00%	55F-95F
Exterior slabs		F1	S0	P0	C2	5000	0.40	1"	4.5%	ASTM C94	0.15%	55F-95F
Frame members		F0	S0	P0	C0	3000	N.R.	1"	N.R.	ASTM C94	1.00%	55F-95F
Walls (interior)		F0	S0	P0	C0	3000	N.R.	1"	N.R.	ASTM C94	1.00%	55F-95F

I. Additional Requirements

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information in accordance with ASTM C94.
   1. Indicate on delivery tickets amounts of mixing water withheld fo permitted addition at Project site, when applicable.

B. Ready-Mixed Concrete: Measure, batch, mix and deliver concrete by volumetric batching and continuous mixing in accordance to ASTM C685, and furnish batch ticket information in accordance with ASTM C685.

PART 3 EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) Class C, 1/2 inch (13 mm) Class D, 1 inch (25 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of] its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

C. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).
   1. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 07920 "Joint Sealants," are indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Water addition is permitted to the maximum quantity indicated on the delivery ticket as is required to be noted in 2.18.A.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature as indicated in 2.16.
   2. Do not place concrete on frozen subgrade or on subgrade containing frozen materials or on surface at a temperature less than 35F.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 95 deg F (32 deg C) at time of placement or as indicated in thermal control plan. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a smooth formed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
   1. Apply scratch finish to surfaces indicated.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces indicated.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 6 inches ((150 mm)) high unless otherwise indicated; and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.

3. Minimum Compressive Strength: 5000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy

rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 14 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one-month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

5. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of discharge from the transportation unit for each composite sample when strength test specimens are prepared. Perform additional tests as required.
      a. Slump Flow: ASTM C1611; one test at point of discharge from the transportation unit for each composite sample when strength test specimens are prepared. Perform additional tests as required.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample when strength test specimens are prepared. Perform additional tests as required.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test for each composite sample when strength test specimens are prepared.
   5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   6. Compression Test Specimens: ASTM C 31/C 31M.
      a. A compressive strength test shall be the average of two 6x12 inch or three 4x8 inch cylinders prepared from the same sample of concrete and tested at the same age.
      b. Cast and standard cure the required number of cylinder specimens for each composite sample based on the test ages indicated in 3.18.E.9
      c. Cast and field cure two two standard cylinder specimens for each composite sample. Field cured cylinders shall be held at the same temperature and moisture conditions as the member containing the concrete they represent.
   7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of standard-cured specimens at 7 days and one set of standard-cured specimens at 28 days.
      a. Test one set of field-cured specimens at 7 days and one set of specimens at 28 days.
   8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
   10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
   11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
   12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by

cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

a. When an individual strength test result is greater than 500 psi less than the specified strength, at least three cores shall be extracted from that portion of the structure represented by the low strength test result. The cores will be conditioned in accordance with ASTM C42.

b. The concrete mixture will be satisfactory if the average of three cores is equal to or greater than 0.85 times the specified strength and the compressive strength of each core is equal to or greater than 0.75 times the specified strength.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 04 2000

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. Concrete building brick.
3. Clay face brick.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.

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.

C. Related Requirements:
1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 072100 "Thermal Insulation" for cavity wall insulation.
3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
1. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
1. Clay face brick.
2. Colored mortar.
3. Weep holes/cavity vents.

D. Samples for Verification: For each type and color of the following:
   1. Clay face brick, in the form of straps of five or more bricks.
   2. Special brick shapes.
   3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   4. Weep holes and cavity vents.
   5. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence according to ASTM C 67.
      d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include name of manufacturer, brand name, and type.
   3. Mortar admixtures.
   4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   5. Grout mixes. Include description of type and proportions of ingredients.
   6. Reinforcing bars.
   7. Joint reinforcement.
   8. Anchors, ties, and metal accessories.

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

D. 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.

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

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
   1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm)] <Insert dimension> long by 48 inches (1200 mm) high by full thickness.
   2. Build sample panels facing south.

3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
4. Clean one-half of exposed faces of panels with masonry cleaner indicated.
5. Protect approved sample panels from the elements with weather-resistant membrane.
6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

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

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
    1. Extend cover a minimum of 24 inches (600 mm) 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 (600 mm) 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 (4 deg C) 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.

2.3 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.

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 and window sills unless otherwise indicated.

B. CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
   2. Density Classification: Normal weight unless otherwise indicated.

3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

C. Concrete Building Brick: ASTM C 55.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
2. Density Classification: Normal weight.
3. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm)by 7-5/8 inches (194 mm) long.

2.5 MASONRY LINTELS

A. 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 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C 216.
1. Grade: SW.
2. Type: FBS.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Size: Modular and Utility.
6. Application: Use where brick is exposed unless otherwise indicated.
7. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork. See drawings for color and type location.

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.
1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

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

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91/C 91M.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cemex S.A.B. de C.V.
      b. Continental Building Products, LLC.
      c. Essroc.
      d. Holcim (US) Inc.
      e. Lehigh Cement Company.

E. Mortar Cement: ASTM C 1329/C 1329M.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Continental Building Products, LLC.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Davis Colors.
      b. Lanxess Corporation.
      c. Solomon Colors, Inc.

G. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Colored Portland Cement-Lime Mix:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Continental Building Products, LLC.
         2) Essroc.
         3) Holcim (US) Inc.
         4) Lehigh Cement Company.
   2. Colored Masonry Cement:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Cemex S.A.B. de C.V.
         2) Continental Building Products, LLC.
         3) Essroc.
         4) Holcim (US) Inc.
         5) Lehigh Cement Company.
   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 or mortar cement by weight.

H. 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 (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) 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.

I. Aggregate for Grout: ASTM C 404.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Construction Chemicals - Construction Systems.
      b. Euclid Chemical Company (The); an RPM company.
      c. Grace Construction Products; W.R. Grace & Co. -- Conn.

K. Water: Potable.

2.8 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dur-O-Wal; a Hohmann & Barnard company.
      b. Heckmann Building Products, Inc.
      c. Hohmann & Barnard, Inc.
      d. Wire-Bond.

C. 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 (3.77-mm) diameter.
   4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
   5. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
   7. Provide in lengths of not less than 10 feet (3 m).

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: truss type with single pair of side rods.

E. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) 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 (38 mm) into veneer but with at least a 5/8-inch (16-mm) 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. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
   2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
   3. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.

4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.35-mm-)] diameter, hot-dip galvanized steel.

D. See Section 040519 for “Masonry Anchors and Accessories” for the post tile and anchor.

2.10 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:
1. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
2. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees[and hemmed].
3. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
4. Fabricate metal expansion-joint strips from copper to shapes indicated.
5. Solder metal items at corners.

B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: 7-oz./sq. ft. (2-kg/sq. m) copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Advanced Building Products Inc.
2) Hohmann & Barnard, Inc.
3) York Manufacturing, Inc.

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 sealant stop or flexible flashing with a metal sealant stop.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Mortar Net USA, Ltd.

E. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
   1. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

F. 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.

G. Termination Bars for Flexible Flashing: Stainless steel bars 0.075 inch by 1 inch 1/8 inch by 1 inch (3 mm by 25 mm).

2.11 MISCELLANEOUS MASONRY ACCESSORIES

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

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

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Provide open head joints @ 24” o.c. for weeps.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advanced Building Products Inc.
      b. CavClear/Archovations, Inc.
      c. Heckmann Building Products, Inc.
      d. Hohmann & Barnard, Inc.
      e. Mortar Net USA, Ltd.
      f. Wire-Bond.
   2. Configuration: Provide one of the following:
      a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.
      b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.12 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.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
      b. EaCo Chem, Inc.
      c. PROSOCO, Inc.

2.13 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 masonry cement or mortar cement mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated[or needed to provide required compressive strength of masonry].
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type M or Type S.
   3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
   3. Application: Use pigmented mortar for exposed mortar joints with the following units:
      a. Clay face brick.

E. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
   3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) 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.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

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 (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) 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 (6 mm in 3 m), or 1/2-inch (12-mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet ((6 mm in 3 m),) or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) 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 (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).[Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).]
   5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) 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 (100-mm) 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 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) 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, and wet brick if required 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 (600 mm) 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. 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush where indicated to receive air barriers unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
1. Fasten seismic anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed 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 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than one anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.
5. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 25 inches (635 mm) o.c. horizontally, with not less than one anchor for each [2.67 sq. ft. (0.25 sq. m)] [3.5 sq. ft. (0.33 sq. m)] of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

B. Provide not less than 2 inches (50 mm)or as indicated 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.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.

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.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL

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 (13 mm) wide between masonry and structural steel 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 (406 mm) o.c. vertically and 16 inches (406 mm) o.c. horizontally.

3.9 CONTROL AND EXPANSION JOINTS

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

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick as follows:
   1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, AND CAVITY VENTS

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

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up as indicated, and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.
   3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
   4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use open-head joints to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.12 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 48 inches.

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

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

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

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

3.14 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 nonmasonry 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 brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
   7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
   8. Clean stone trim to comply with stone supplier's written instructions.

3.15 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. 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

SECTION 05 3100

STEEL DECK

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. Roof deck.

B. Related Requirements:
   1. Section 05500 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
   2. Section 09911 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
   3. Section 09912 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Fire-Resistance Ratings: Comply with ASTM E 119; 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 the listings of another qualified testing agency.

C. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
a. Color: Manufacturer's standard.
2. Deck Profile: Type B, wide rib.
3. Profile Depth: 1-1/2 inches **(38 mm).**
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.

6. Side Laps: Overlapped.

2.3 ACCESSORIES

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

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

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

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

G. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and sloped recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION, GENERAL

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

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

C. Locate deck bundles to prevent overloading of supporting members.

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

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

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

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

H. Mechanical fasteners are to be used to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by mechanical fastening.

B. Mechanically fasten with self drilling, No. 12 diameter or larger, carbon-steel screws.
1. Screw Spacing: Fasten edge and interior ribs of deck units with a minimum of 2 screws per deck unit at each support. Space fasteners 12 inches (305 mm) apart in the field of roof.

C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches **(457 mm)** and as follows:
1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
1. End Joints: Lapped 2 inches **(51 mm)** minimum.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.
1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
1. Mechanically fasten cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Roof deck fastening will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

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

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
   2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09911 "Exterior Painting" and Section 09912 "Interior Painting."

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 09911 "Exterior Painting" and Section 09912 "Interior Painting."

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 4400

COLD-FORMED METAL TRUSSES

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 cold-formed steel framing in the form of the following:
   1. Cold-formed steel trusses for roofs.

B. Related Requirements:
   1. Section 052100 "Steel Joist Framing" for trusslike, steel floor or roof joists and joist girders.
   2. Section 054000 "Cold-Formed Metal Framing" for cold-formed steel studs, joists, and rafters.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel trusses.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
   1. Steel sheet.
   2. Expansion anchors.
   3. Power-actuated anchors.
   4. Mechanical fasteners.
   5. Miscellaneous structural clips and accessories.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

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

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect cold formed steel trusses from corrosion, deformation and other damage during delivery, storage and handling.

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. Aegis Metal Framing.
2. Marino\WARE.
3. TrusSteel; an ITW company.
4. USA Frametek.
5. WESTCO Steel Systems, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel trusses.

B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:
a. Roof Trusses: Vertical deflection of 1/360 of the span.
3. Design trusses to provide for movement of truss members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses shall comply with the following:
1. Floor and Roof Systems: AISI S210.
2. Lateral Design: AISI S213.
3. Roof Trusses: AISI S214.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL TRUSS MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: ST33H (ST230H).

2.4 TRUSS ACCESSORIES

A. Fabricate steel-truss accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.

B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Power-Actuated Fasteners: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20.

B. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

2.7 FABRICATION

A. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate trusses using jigs or templates.
2. Cut truss members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

4. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual truss members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting trusses and framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed steel trusses without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.
1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.
2. Anchor trusses securely at all bearing points.
3. Install continuous bridging and permanently brace trusses as indicated on Drawings.

B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.
1. Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.
2. Erect trusses without damaging truss members or connections.
3. Fasten cold-formed steel trusses by welding or mechanical fasteners.
a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

C. Install temporary bracing and supports to secure trusses and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to trusses are secured.

D. Do not alter, cut, or remove truss members or connections of trusses.

3.4 ERECTION TOLERANCES

A. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual trusses no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Cold-Formed Steel Trusses Spanning 60 ft. (18,288 mm) or Longer: Verify temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed according to the approved truss submittal package.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Cold-formed metal trusses will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel trusses are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

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. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Miscellaneous steel trim including.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:
1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 051200 "Structural Steel Framing."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations 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.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:
1. Steel tube reinforcement for low partitions.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Shelf angles.
5. Miscellaneous steel trim including.
6. Loose steel lintels.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 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 Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy [Group 1 (A1)] [Group 2 (A4)].

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors 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 according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.3 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" Section 099123 Interior Painting".

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

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

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

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

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

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

I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.4 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.

2.5 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.

C. Galvanize miscellaneous framing and supports where indicated.

2.6 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 shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.7 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 exterior miscellaneous steel trim.

2.8 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 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.9 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

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.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M 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 railings 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 universal shop primer.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast 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.

2.12 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 INSTALLING 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. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."

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

END OF SECTION

SECTION 07 1113

BITUMINOUS DAMPPROOFING

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. Cold-applied, emulsified-asphalt dampproofing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. APOC, Inc; a division of Gardner Industries.
2. BASF Construction Chemicals - Construction Systems.
3. Brewer Company (The).
4. ChemMasters, Inc.
5. Euclid Chemical Company (The); an RPM company.
6. Henry Company.
7. Karnak Corporation.
8. Koppers Inc.
9. Malarkey Roofing Company.
10. W.R. Meadows, Inc.

B. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.

C. Brush and Spray Coats: ASTM D 4479, Type I, fibered or nonfibered.

D. VOC Content: [250] [300] <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. APOC, Inc; a division of Gardner Industries.
2. BASF Construction Chemicals - Construction Systems.
3. Brewer Company (The).
4. ChemMasters, Inc.
5. Euclid Chemical Company (The); an RPM company.
6. Gardner-Gibson, Inc.
7. Henry Company.
8. ITW Polymers Sealants North America (formerly Pacific Polymers, Inc.).
9. Karnak Corporation.
10. Koppers Inc.
11. Malarkey Roofing Company.
12. W.R. Meadows, Inc.

B. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.4 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Cut-Back-Asphalt Primer: ASTM D 41.

C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
1. Primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

E. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
   1. Apply dampproofing to provide continuous plane of protection.
   2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
   1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
   2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch (6 mm) onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
   1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
   2. Lap dampproofing at least 1/4 inch (6 mm) onto shelf angles supporting veneer.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Masonry Backup for Brick Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

B. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

3.5 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

SECTION 07 2100

THERMAL INSULATION

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. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for insulation installed in masonry cells.
2. Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing", Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" "] for insulation specified as part of roofing construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 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 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

B. Extruded Polystyrene Board, Type IV <Insert drawing designation>: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

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

   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Owens Corning.
   d. Pactiv Corporation.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

C. Extruded Polystyrene Board, Type VI Underslab and Foundation: ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

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

   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Owens Corning.
   d. Pactiv Corporation.
   e. Soprema, Inc.

2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced <Insert drawing designation>: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

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

   a. CertainTeed Corporation.
   b. Guardian Building Products, Inc.
   c. Johns Manville; a Berkshire Hathaway company.
   d. Knauf Insulation.

e. Owens Corning.

2.3 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, provide products by one of 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. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.4 ACCESSORIES

A. 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.

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 that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. 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 according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to 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. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to 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 by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. 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

SECTION 07 4113.16

STANDING-SEAM METAL ROOF PANELS

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 standing-seam metal roof panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof area and eave, including fascia, and soffit as shown on Drawings; approximately 12 feet (3.5 m) square by full thickness, including attachments, underlayment, and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advanced Architectural Products.
      b. Advanced Building Products Inc.
      c. AEP Span; A BlueScope Steel Company.
      d. Architectural Building Components.
      e. Architectural Metal Systems.
      f. ATAS International, Inc.
      g. Berridge Manufacturing Company.
      h. CENTRIA Architectural Systems.
      i. Dimensional Metals, Inc.
      j. Englert, Inc.
      k. Fabral.
      l. Firestone Building Products.
      m. Firestone Metal Products, LLC.
      n. Flexospan Steel Buildings, Inc.
      o. Garland Company, Inc. (The).
      p. IMETCO.
      q. MBCI; a division of NCI Group, Inc.
      r. McElroy Metal, Inc.
      s. Merchant & Evans Inc.
      t. Metal Sales Manufacturing Corporation.
      u. Metal-Fab Manufacturing, LLC.
      v. Morin - A Kingspan Group Company.
      w. Petersen Aluminum Corporation.
      x. Ryerson Tull, Inc.
      y. Ultra Seam Incorporated.
   2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
      a. Nominal Thickness: 0.028 inch (0.71 mm).
      b. Exterior Finish: Three-coat fluoropolymer.
      c. Color: As selected by Architect from manufacturer's full range.
   3. Clips: Two-piece floating to accommodate thermal movement.
      a. Material: 0.064-inch- (1.63-mm-) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
   4. Joint Type: As standard with manufacturer.
   5. Panel Coverage: to match existing roof.
   6. Panel Height: to match existing roof.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Carlisle Residential; a division of Carlisle Construction Materials.

b. Grace Construction Products; W.R. Grace & Co. -- Conn.
c. Henry Company.
d. Kirsch Building Products, LLC.
e. Metal-Fab Manufacturing, LLC.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray 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.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
   3. Custom Color to match existing roof panel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
   2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
   4. Watertight Installation:
      a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
      b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
      c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

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. Formed roof-drainage sheet metal fabrications.
2. Formed equipment support flashing.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 07 95 00 "Expansion Control" for manufactured sheet metal expansion-joint covers.
4. Section 07 71 00 Roof Specialties for copings, roof edge drainage systems and reglets and counterflashing.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Include details of special conditions.
3. Include details of connections to adjoining work.
4. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is FM Approvals approved.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: 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.

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. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

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 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 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall 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 shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" 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 to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: Custom color to match exiting trim
3. 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).

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, 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.

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 Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. 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.

D. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [polysulfide] [silicone] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. 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.
2. Obtain field measurements for accurate fit before shop fabrication.
3. 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.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (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.

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 to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

2.5 SHEET METAL FABRICATIONS

A. Fascia Trim: Fabricate from the following materials: Shop fabricate interior and exterior corners.

1. Galvanized Steel: 0.034 inch (0.86 mm) thick.

B. Base Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel:0.022 inch (0.56 mm) thick.

D. Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, 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 sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

C. 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.

D. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm). Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with [elastomeric] [butyl] sealant and clamp flashing to pipes that penetrate roof.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (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.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. 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.

END OF SECTION

SECTION 07 7100

ROOF SPECIALTIES

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. Roof-edge drainage systems.

B. Related Requirements:
   1. Section 055000 "Metal Fabrications" for downspout guards and downspout boots.
   2. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
   4. Section 077129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
   5. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
   6. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
   7. Section 079500 "Expansion Control" for manufactured sheet metal expansion-joint covers.
   8. Section 07417 “Roof Underlayment”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.
   1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
   2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
   3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
   4. Detail termination points and assemblies, including fixed points.
   5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 07 55 52 Modified Bituminous Protected Membrane Roofing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ROOF-EDGE DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Architectural Products Company.
   2. ATAS International, Inc.
   3. Berger Building Products, Inc.
   4. Castle Metal Products.
   5. Cheney Flashing Company.
   6. CopperCraft by FABRAL.
   7. Hickman Company, W. P.
   8. Merchant & Evans Inc.
   9. Metal-Era, Inc.
   10. Metal-Fab Manufacturing, LLC.
   11. Perimeter Systems; a division of SAF.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

C. Downspouts: Plain rectangular complete with machine-crimped mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Zinc-Coated Steel: Nominal 0.034-inch (0.86-mm) thickness.

D. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
   1. Color: As selected by Architect from manufacturer's full range.

2.3 COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Castle Metal Products.
   2. Cheney Flashing Company.

3. Fry Reglet Corporation.
4. Heckmann Building Products, Inc.
5. Hickman Company, W. P.
6. Keystone Flashing Company, Inc.
7. Metal-Era, Inc.

B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.

C. Accessories:
1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

D. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
1. Color: As selected by Architect from manufacturer's full range.

2.4 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

B. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [silicone] polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Galvanized-Steel Sheet Finishes:
   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A 755/A 755M and coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
      c. Custom color to match existing downspout and gutters

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

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

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152mm) staggered 24 inches (610mm) between courses. Overlap side edges not less than 3-1/2 inches (90mm). Roll pals with roller. Cover underlayment within 14 days.
   1. Apply continuously under copings.

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
   1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   2. Provide uniform, neat seams with minimum exposure of solder and sealant.
   3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
   4. Torch cutting of roof specialties is not permitted.
   5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
   1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
   2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
   1. Provide elbows at base of downspouts at grade to direct water away from building.

3.5 COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of counterflashings with installation of base flashings.

B. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 7200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Roof curbs.
2. Equipment supports.
3. Preformed flashing sleeves.

B. Related Sections:
1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
3. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 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.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 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.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.8 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      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 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation and mill phosphatized for field painting where indicated.
   1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
   2. 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. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

C. Steel Tube: ASTM A 500, round tube.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

E. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.

C. 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.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Fasteners: Roof accessory manufacturer's recommended fasteners 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 Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

F. 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.

G. Elastomeric Sealant: ASTM C 920, elastomeric 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.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints,stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Loads: <Insert load requirements>.

D. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch, 0.079 inch (2.01 mm) thick.
   1. Finish: Two-coat fluoropolymer, Baked enamel or powder coat.
   2. Color: As selected by Architect from manufacturer's full range.

E. Construction:
   1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
   2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
   3. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
   4. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
   5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
   6. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints,stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) 0.079 inch (2.01 mm) > thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As selected by Architect from manufacturer's full range.

D. Construction:
   1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
   2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
   3. Factory-installed continuous wood nailers 3-1/2 inches (90 mm) wide at tops of equipment supports.
   4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
   5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
   6. Fabricate equipment supports to minimum height of 12 inches (300 mm) unless otherwise indicated.
   7. Sloping Roofs: Where roof slope exceeds 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.
   8. Security Grille: Provide where indicated.

2.5 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and [slotted] [perforated] metal collar.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Solution Roof and Metal Products.
      b. Thaler Metal Industries Ltd.
   2. Metal: Copper sheet, 16 oz. (0.55 mm) thick.
   3. Diameter: As indicated.
   4. Finish:Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Solution Roof and Metal Products.
      b. Lifetime Tool & Building Products, LLC.
      c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      d. Thaler Metal Industries Ltd.
   2. Metal: Copper sheet, 16 oz. (0.55 mm) thick.
   3. Height: As indicated.
   4. Diameter: As indicated.
   5. Finish: Manufacturer's standard.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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

A. General: Install roof accessories according to manufacturer's written instructions.
1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, 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 by manufacturer.
1. Coat concealed side of 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.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Roof-Hatch Installation:
1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach ladder-assist post according to manufacturer's written instructions.

F. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

G. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Silyl-terminated polyether joint sealants.
6. Mildew-resistant joint sealants.
7. Polysulfide joint sealants.
8. Butyl joint sealants.
9. Latex joint sealants.

B. Related Requirements:
1. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

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

C. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

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

C. 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.

D. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (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.

1.7 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 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.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. May National Associates, Inc.; a subsidiary of Sika Corporation.
      b. Pecora Corporation.
      c. Tremco Incorporated.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Construction Chemicals - Construction Systems.
      b. Bostik, Inc.
      c. ER Systems; an ITW Company.
      d. Pecora Corporation.
      e. Polymeric Systems, Inc.
      f. Schnee-Morehead, Inc., an ITW company.
      g. Sherwin-Williams Company (The).
      h. Sika Corporation.
      i. Tremco Incorporated.

2.4 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 C 920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. May National Associates, Inc.; a subsidiary of Sika Corporation.
      d. Soudal USA.
      e. Tremco Incorporated.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bostik, Inc.
      b. Pecora Corporation.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Construction Chemicals - Construction Systems.
      b. May National Associates, Inc.; a subsidiary of Sika Corporation.
      c. Pecora Corporation.

d. Sherwin-Williams Company (The).
e. Tremco Incorporated.

2.7 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.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. BASF Construction Chemicals - Construction Systems.
b. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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.

2.8 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. Masonry.
   b. Unglazed surfaces of ceramic tile.
3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a. Metal.
   b. Glass.
   c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install 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.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
      b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
   4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
   5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

3.6 PROTECTION

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

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-1.
   1. Joint Locations:
      a. Control and expansion joints in unit masonry.

b. Joints between different materials listed above.
c. Perimeter joints between materials listed above and frames of doors, windows and louvers.
d. Control and expansion joints in ceilings and other overhead surfaces.
e. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-2.
1. Joint Locations:
a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Tile control and expansion joints.
c. Vertical joints on exposed surfaces of unit masonry, walls and partitions.
d. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement JS-3.
1. Joint Locations:
a. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
b. Other joints as indicated on Drawings.
2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-4.
1. Joint Locations:
a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Concealed mastics[JS-5.
1. Joint Locations:
a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.
2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

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 hollow-metal work.

B. Related Requirements:
1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:
1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amweld International, LLC.
2. Apex Industries, Inc.
3. Ceco Door; ASSA ABLOY.
4. Commercial Door & Hardware Inc.
5. Concept Frames, Inc.
6. Curries Company; ASSA ABLOY.
7. Custom Metal Products.
8. Daybar Industries, Ltd.
9. DE LA FONTAINE.
10. Deansteel Manufacturing Company, Inc.
11. DKS Steel Door & Frame Systems, Inc.
12. Door Components, Inc.
13. Fleming Door Products Ltd.; Assa Abloy Group Company.
14. Gensteel Doors, Inc.
15. Greensteel Industries, Ltd.
16. HMF Express, LLC.
17. Hollow Metal Inc.
18. Hollow Metal Xpress.
19. J/R Metal Frames Manufacturing, Inc.
20. Karpen Steel Custom Doors & Frames.
21. L.I.F. Industries, Inc.
22. LaForce, Inc.
23. Megamet Industries, Inc.
24. Mesker Door Inc.
25. Michbi Doors Inc.
26. MPI Group, LLC (The).

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and

temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches (44.5 mm).
   c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch (1.3 mm).
   d. Edge Construction:Model 2, Seamless.
   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
3. Frames:
   a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch (1.3 mm).
   b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches (44.5 mm.)
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
   d. Edge Construction:Model 2, Seamless].
   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
      1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
3. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
   b. Construction: Full profile welded.

2.5 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
   2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
   1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
   2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
   3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
   4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
   5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
   6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
         1) Two anchors per jamb up to 60 inches (1524 mm) high.
         2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
         3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
         4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
   6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   4. Provide loose stops and moldings on inside of hollow-metal work.
   5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.10 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
   1. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install door silencers in frames before grouting.
      d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
   4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Steel Doors:
      a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
      b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
      c. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).

d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 1416

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Solid-core doors and transom panels with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Doors to be factory finished and finish requirements.
2. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 WARRANTY

A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABS- American Building Supply- Doormerica.
   2. Algoma Hardwoods, Inc.
   3. Ampco Products, LLC.
   4. Chappell Door Co.
   5. Eggers Industries.
   6. General Veneer Manufacturing Co.
   7. Graham Wood Doors; ASSA ABLOY Group company.
   8. Haley Brothers, Inc.
   9. Ipik Door Company.
   10. Lambton Doors.
   11. Marlite.
   12. Marshfield DoorSystems, Inc.
   13. Mohawk Flush Doors, Inc.
   14. Oregon Door.
   15. Oshkosh Door Company.
   16. Poncraft Door Company.
   17. Vancouver Door Company.
   18. VT Industries Inc.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
   1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
   3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.
2. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

F. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
a. Screw Withdrawal, Face: 700 lbf (3100 N).
b. Screw Withdrawal, Edge: 400 lbf (1780 N).

G. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors <Insert drawing designation>:
1. Grade: Premium, with Grade AA faces.
2. Species: Cherry.
3. Cut: Quarter sliced.
4. Assembly of Veneer Leaves on Door Faces: Center-balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Core: Particleboard.
7. Construction: Seven plies, either bonded or nonbonded construction.
8. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

D. Metal Louvers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Air Louvers Inc.; a Division of the Activar Construction Products Group.

b. Anemostat Products; a Mestek company.
c. L & L Louvers, Inc.
d. Louvers & Dampers, Inc.; a division of Mestek, Inc.
e. McGill Architectural Products.

2. Blade Type: Vision-proof, inverted V
3. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
1. Grade: Premium
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish or System 11, catalyzed polyurethane.
3. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware.".

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire-rated doors according to NFPA 80.
   2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 5113

ALUMINUM WINDOWS

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 aluminum windows for exterior locations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) in size.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
   c. Faulty operation of movable sash and hardware.
   d. Deterioration of materials and finishes beyond normal weathering.
   e. Failure of insulating glass.
2. Warranty Period:
   a. Window: 10 years from date of Substantial Completion.
   b. Glazing Units: 10 years from date of Substantial Completion.
   c. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. EFCO Corporation – Xtherm HX45.
   2. Kawneer North America; an Alcoa company. – 8400TL
   3. Peerless Products Inc. – GSH5

B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   1. Window Certification: AMMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: AW.
   2. Minimum Performance Grade: 50.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K).

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

G. Outside-Inside Transmission Class (OITC): Rated for not less than 26 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Single hung.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units: ASTM E 2190, certified through IGCC as complying with requirements of IGCC.
   1. Glass: ASTM C 1036, Type 1, Class 1, q3.
      a. Tint: Clear.
      b. Kind: Fully tempered.
   2. Lites: Two.
   3. Filling: Fill space between glass lites with argon.
   4. Low-E Coating: Sputtered on second or third surface.

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

F. Hung Window Hardware:
   1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
   2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
   3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

H. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Subsills: Thermally broke, extruded-aluminum subsills in configurations indicated on Drawings.

B. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" 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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   1. Color: Bronze to match existing windows

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

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. Mechanical door hardware for the following:
      a. Swinging doors.
   2. Cylinders for door hardware specified in other Sections.
   3. Electrified door hardware.

B. Related Sections:
   1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: For power, signal, and control wiring and including the following:
      a. Details of interface of electrified door hardware and building safety and security systems.
      b. Schematic diagram of systems that interface with electrified door hardware.
      c. Point-to-point wiring.
      d. Risers.
      e. Elevations doors controlled by electrified door hardware.
   2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

D. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
   1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.
      a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

E. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
   b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
   c. Content: Include the following information:
      1) Identification number, location, hand, fire rating, size, and material of each door and frame.
      2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
      5) Fastenings and other pertinent information.
      6) Explanation of abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for door hardware.
      8) List of related door devices specified in other Sections for each door and frame.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For electrified door hardware, from the manufacturer.
   1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Warehousing Facilities: In Project's vicinity.

2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
1. For door hardware, an Architectural Hardware Consultant (AHC) who is also an Electrified Hardware Consultant (EHC).

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of doors and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
      a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
      b. Exit Devices: Two years from date of Substantial Completion.
      c. Manual Closers: 10> years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bommer Industries, Inc.
      b. Hager Companies.
      c. Ives; an Ingersoll Rand brand.
      d. McKinney Products Company; an ASSA ABLOY Group company.
      e. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.3 CONTINUOUS HINGES

A. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bommer Industries, Inc.
      b. Ives; an Ingersoll Rand brand.
      c. McKinney Products Company; an ASSA ABLOY Group company.
      d. Select Products Limited.
      e. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
   2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
   3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

D. Lock Trim:
   1. Levers: Wrought.

2. Knobs: Wrought.
3. Escutcheons (Roses): Wrought.
4. Dummy Trim: Match lever lock trim and escutcheons.
5. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
b. Medeco Security Locks; an ASSA ABLOY Group company.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Schlage; an Ingersoll-Rand brand.
e. Yale Security Inc; an ASSA ABLOY Group company.

G. Mortise Locks: BHMA A156.13; Security Grade 1; stamped steel case with steel or brass parts; Series 1000.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
b. SARGENT Manufacturing Company; ASSA ABLOY.
c. Schlage; an Ingersoll-Rand brand.
d. Yale Security Inc; an ASSA ABLOY Group company.

H. Interconnected Locks: BHMA A156.12; Grade [1] [2]; Series 5000.
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. Arrow USA; an ASSA ABLOY Group company.
b. Falcon; an Ingersoll-Rand brand.
c. Schlage; an Ingersoll-Rand brand.

I. Roller Latches: BHMA A156.16; Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Architectural Builders Hardware Mfg., Inc.
b. Baldwin Hardware Corporation.
c. Don-Jo Mfg., Inc.
d. Door Controls International, Inc.
e. Ives; an Ingersoll Rand brand.
f. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
g. Stanley Commercial Hardware; a division of Stanley Security Solutions.

J. Push-Pull Latches: Bored, BHMA A156.2; Series 4000, Mortise, BHMA A156.13; Grade 1; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
b. Architectural Builders Hardware Mfg., Inc.
c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
d. Don-Jo Mfg., Inc.
e. Glynn-Johnson; an Ingersoll-Rand brand.
f. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
g. SARGENT Manufacturing Company; ASSA ABLOY.
h. Trimco.

2.5 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.5: Grade 1; with strike that suits frame.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Medeco Security Locks; an ASSA ABLOY Group company.
b. SARGENT Manufacturing Company; ASSA ABLOY.
c. Schlage; an Ingersoll-Rand brand.
d. Yale Security Inc; an ASSA ABLOY Group company.

B. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. SARGENT Manufacturing Company; ASSA ABLOY.
b. Schlage; an Ingersoll-Rand brand.
c. Yale Security Inc; an ASSA ABLOY Group company.

2.6 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Folger Adam, a brand of HES; an ASSA ABLOY Group company.
b. HES, Inc.; an ASSA ABLOY Group company.
c. Rutherford Controls Int'l. Corp.
d. Security Door Controls.
e. Trine Access Technology.
f. Von Duprin; an Ingersoll-Rand brand.

2.7 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Door Controls International, Inc.
b. Dortronics Systems, Inc.
c. DynaLock Corp.
d. Rutherford Controls Int'l. Corp.
e. Schlage; an Ingersoll-Rand brand.
f. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
g. Security Door Controls.

B. Delayed-Egress Electromagnetic Locks: BHMA A156.24, electrically powered, with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than 3 seconds initiates irreversible alarm and 15-second delay for egress. When integrated with fire alarm, fire alarm voids 15-second delay.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Door Controls International, Inc.
   b. Doorguard Systems, Inc.
   c. DynaLock Corp.
   d. Rutherford Controls Int'l. Corp.
   e. Schlage; an Ingersoll-Rand brand.
   f. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

2.8 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; mortise deadlocking latchbolt; with strike that suits frame.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. SARGENT Manufacturing Company; ASSA ABLOY.
      b. Schlage; an Ingersoll-Rand brand.
      c. Yale Security Inc; an ASSA ABLOY Group company.

2.9 SELF-CONTAINED ELECTRONIC LOCKS

A. Self-Contained Electronic Locks: BHMA A156.25, mortise; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. SARGENT Manufacturing Company; ASSA ABLOY.
      b. Schlage; an Ingersoll-Rand brand.
      c. Yale Security Inc; an ASSA ABLOY Group company.

2.10 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks and Alarms: BHMA A156.29, Grade 1.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Arrow USA; an ASSA ABLOY Group company.
      b. Detex Corporation.
      c. SARGENT Manufacturing Company; ASSA ABLOY.

2.11 SURFACE BOLTS

A. Surface Bolts: BHMA A156.16.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Door Controls International, Inc.
      b. Ives; an Ingersoll Rand brand.
      c. Trimco.

2.12 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.

b. Burns Manufacturing Incorporated.
c. Door Controls International, Inc.
d. Ives; an Ingersoll Rand brand.
e. Trimco.

2.13 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
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. Door Controls International, Inc.
b. Ives; an Ingersoll Rand brand.
c. Trimco.

2.14 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
b. Arrow USA; an ASSA ABLOY Group company.
c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
d. Detex Corporation.
e. Door Controls International, Inc.
f. DORMA Architectural Hardware; a division of DORMA Group North America.
g. Dor-O-Matic, an Ingersoll-Rand brand.
h. Hager Companies.
i. Precision Hardware, Inc.; a Stanley company.
j. SARGENT Manufacturing Company; ASSA ABLOY.

2.15 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
1. Manufacturer: Same manufacturer as for locking devices.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASSA, Inc.
b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
c. Hager Companies.
d. Medeco Security Locks; an ASSA ABLOY Group company.
e. SARGENT Manufacturing Company; ASSA ABLOY.
f. Yale Security Inc; an ASSA ABLOY Group company.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.

C. High-Security Lock Cylinders: BHMA A156.30; Grade 1; Type M, mechanical E, electrical; permanent cores that are removable; face finished to match lockset.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.16 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
   1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
   2. Existing System:
      a. Master key or grand master key locks to Owner's existing system.

B. Keys: Nickel silver.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE."
   2. Quantity: In addition to one extra key blank for each lock, provide the following:
      a. Cylinder Change Keys: Three.
      b. Master Keys: Five.
      c. Grand Master Keys: Five.
      d. Great-Grand Master Keys: Five.

2.17 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Key Boxes and Cabinets.
      b. GE Security, Inc.
      c. HPC, Inc.
      d. Lund Equipment Co., Inc.
      e. MMF Industries.
      f. Oasis International; a Lynn Tilton company.
   2. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.
   3. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
   4. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

2.18 OPERATING TRIM

A. Operating Trim: BHMA A156.6; bronze, unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Burns Manufacturing Incorporated.
      b. Don-Jo Mfg., Inc.
      c. Forms+Surfaces.
      d. Hager Companies.
      e. Hiawatha, Inc; a division of the Activar Construction Products Group.
      f. Ives; an Ingersoll Rand brand.
      g. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
      h. Trimco.

2.19 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.20 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
      b. Dor-O-Matic, an Ingersoll-Rand brand.
      c. LCN; an Ingersoll-Rand brand.
      d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
      e. SARGENT Manufacturing Company; ASSA ABLOY.
      f. Yale Security Inc; an ASSA ABLOY Group company.

2.21 CONCEALED CLOSERS

A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. LCN; an Ingersoll-Rand brand.
      b. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
      c. SARGENT Manufacturing Company; ASSA ABLOY.

2.22 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system loss of power.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
      b. LCN; an Ingersoll-Rand brand.
      c. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
      d. SARGENT Manufacturing Company; ASSA ABLOY.

2.23 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Baldwin Hardware Corporation.
      b. Burns Manufacturing Incorporated.
      c. Hager Companies.
      d. Ives; an Ingersoll Rand brand.
      e. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
      f. Stanley Commercial Hardware; a division of Stanley Security Solutions.
      g. Trimco.

2.24 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Builders Hardware Mfg., Inc.
      b. DORMA Architectural Hardware; a division of DORMA Group North America.
      c. SARGENT Manufacturing Company; ASSA ABLOY.

2.25 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Builders Hardware Mfg., Inc.
      b. Glynn-Johnson; an Ingersoll-Rand brand.
      c. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
      d. SARGENT Manufacturing Company; ASSA ABLOY.

2.26 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. M-D Building Products, Inc.
      b. National Guard Products, Inc.
      c. Pemko Manufacturing Co.
      d. Reese Enterprises, Inc.
      e. Zero International, Inc.

2.27 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. National Guard Products, Inc.
      c. Pemko Manufacturing Co.
      d. Reese Enterprises, Inc.

e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
f. Zero International, Inc.

2.28 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick brass; with manufacturer's standard machine or self-tapping screw fasteners.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Burns Manufacturing Incorporated.
b. InPro Corporation (IPC).
c. Ives; an Ingersoll Rand brand.
d. Pawling Corporation.
e. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
f. Trimco.

2.29 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Baldwin Hardware Corporation.
b. Hager Companies.
c. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.
e. Trimco.

2.30 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. DynaLock Corp.
b. GE Security, Inc.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Schlage; an Ingersoll-Rand brand.
e. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
f. Security Door Controls.

2.31 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Fire-Rated Applications:
      a. Wood or Machine Screws: For the following:
         1) Hinges mortised to doors or frames[; use threaded-to-the-head wood screws for wood doors and frames].
         2) Strike plates to frames.
         3) Closers to doors and frames.
      b. Steel Through Bolts: For the following unless door blocking is provided:
         1) Surface hinges to doors.
         2) Closers to doors and frames.
         3) Surface-mounted exit devices.
   3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
   4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
   5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.32 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, accessible ceilings. Verify location with Architect.
1. Configuration: Provide one power supply for each door opening with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Contractor will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
   1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DOOR HARDWARE SCHEDULE

A. The following schedule is furnished for whatever assistance it may afford the Contractor; do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware heading, provide door or item with hardware same as required for similar purposes. Hardware supplier is responsible for handling and sizing all products as listed in the hardware heading. Quantities listed are for each pair of doors, or for each single door.

Set: 01 - Description: Exterior Pair 3070 Flush Hollow Metal Door x Hollow Metal Frame

2 ea. Full Mortise Edge Hung Continuous Geared Hinges MCK-25HD CL MK
1 ea. Rim Exit (RHR) 12-43-8816-824 26D SA
1 ea. Rim Exit (LHR) 12-43-8816-821 26D SA
1 ea. Lockable Removable Mullion w/ cylinder 12-L980S Primed SA
1 ea. Cylinder 626 ME
2 ea. Closer 281 CPS EN SA
1 ea. Threshold 2005AP PE
2 ea. Wall Stop 403 26D RO
1 ea. Weatherstripping 303AS PE

Set: 02 - Description: Interior Pair 3068 Double Egress Hollow Metal Doors x Hollow Metal Frame

2 ea. Full Mortise Edge Hung Continuous Geared Hinges MCK-25HD CL MK
1 ea. Low Profile Concealed Vertical Rod Exit 12-43-LC-LP8615xETL 26D SA
1 ea. Low Profile Concealed Vertical Rod Exit 12-43-LC-LR8615xETL 26D SA
2 ea. Electrified Closer/Holder (24VAC/DC)* SMOK-CHEK V – 0601 689 RX

*Provide release switch for releasing hold open. Coordinated with Electrical Division for power and conduit requirements.

Set: 03 - Description: Interior 3070 Solid Core Wood Door x Hollow Metal Frame

3 ea. Hinges TA2714 4 1/2 x 4 1/2 26D MK
1 ea. Lockset 11-21-8237 LNJ 26D SA
1 ea. Wall Stop 403 26D RO
3 ea. Silencers 12-L980S Primed SA

Set: 04 - Description: Interior 3070 Solid Core Wood Door x Hollow Metal Frame

3 ea. Hinges TA2714 4 1/2 x 4 1/2 26D MK
1 ea. Lockset 49-8265 LNJ 26D SA
1 ea. Wall Stop 403 26D RO
3 ea. Silencers 12-L980S Primed SA

Set: 05 - Description: Interior 3070 Solid Core Wood Door x Hollow Metal Frame

3 ea. Hinges TA2714 4 1/2 x 4 1/2 26D MK
1 ea. Lockset 11-21-8204 LNJ 26D SA
1 ea. Wall Stop 403 26D RO
3 ea. Silencers 12-L980S Primed SA

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Glass for windows, doors, interior borrowed lites storefront framing.
   2. Glazing sealants and accessories.

B. Related Requirements:
   1. Section 088300 "Mirrors."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

B. Preconstruction adhesion and compatibility test report.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

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 Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Agalite; Hartung Glass Industries.
   2. AGC Glass Company North America.
   3. Cardinal Glass Industries.
   4. Cristacurva.
   5. Dlubak Corporation.
   6. Gardner Glass, Inc.
   7. GGI; General Glass International.
   8. Glasswerks LA, Inc.
   9. GTI; Glaz-Tech Industries.
   10. Guardian Industries Corp.; SunGuard.
   11. JE Berkowitz, LP.
   12. Northwestern Industries, Inc.
   13. Oldcastle BuildingEnvelope™.

14. Pilkington North America.
15. PPG Industries, Inc.
16. Schott North America, Inc.
17. Tecnoglass.
18. Trulite Glass & Aluminum Solutions, LLC.
19. Vetrotech Saint-Gobain.
20. Viracon, Inc.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
   1. Obtain tinted glass from single source from single manufacturer.
   2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
   1. Design Wind Pressures: As indicated on Drawings.
   2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
      a. Wind Design Data: As indicated on Drawings.
   3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
   4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass[as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.

2.6 GLAZING SEALANTS

A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel

substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.
   a. Dow Corning Corporation.
   b. GE Construction Sealants; Momentive Performance Materials Inc.
   c. May National Associates, Inc.; a subsidiary of Sika Corporation.
   d. Pecora Corporation.
   e. Sika Corporation.
   f. Tremco Incorporated.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

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 by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, 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 glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type: Clear fully tempered float glass.
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

A. Glass Type: Low-E-coated, clear insulating glass.
   1. Basis-of-Design Product: Viracon VUE 1-40..
   2. Overall Unit Thickness: 1 inch (25 mm).
   3. Minimum Thickness of Each Glass Lite: 6 mm.
   4. Outdoor Lite: Fully tempered float glass.
   5. Interspace Content: Argon.
   6. Indoor Lite: Fully tempered float glass.
   7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
   8. Winter Nighttime U-Factor: 0.24 maximum.
   9. Summer Daytime U-Factor: 0.20 maximum.
   10. Solar Heat Gain Coefficient: 0.25 maximum.
   11. Safety glazing required.

END OF SECTION

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. United States Gypsum Company.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type III, mineral base with membrane-faced overlay; Form 2.

C. Color: White.

D. LR: Not less than 0.85.

E. NRC: Not less than 0.70.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members.

H. Thickness: 5/8 inch (15 mm).

I. Modular Size: As indicated on Drawings.

J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
   1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Type: Postinstalled expansion anchors.
      b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-).

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

J. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. United States Gypsum Company.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. Fry Reglet Corporation.
5. Gordon, Inc.
6. United States Gypsum Company.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements

specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for

hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. Install panels in a basket-weave pattern.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
   3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
   5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
   6. Install hold-down impact clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
   7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
   1. Compliance of seismic design.

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

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
   1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
      a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.

b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6500

RESILIENT FLOOR TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section Includes:
1. BioBased floor tile.

1.2 RELATED DOCUMENTS

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

B. SECTION 09 65 13 – RESILIENT WALL BASE AND ACCESSORIES.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of floor tile indicated.

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 that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Floor Tile: Furnish one box for every of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

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 time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Close spaces to traffic during floor tile installation.

C. Close spaces to traffic for 48 hours after floor tile installation.

D. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 POLYESTER COMPOSITION FLOOR TILE

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   1. Armstrong World Industries, Inc – Basis of Design– Biobased Floor tile – Striations and Migrations
   2. Approved Equal

B. Tile Standard: ASTM F 2982, through-pattern tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches and 12 by 24.

F. Colors and Patterns: See finish schedule

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. 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 F 710.
   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 pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

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 they are the same temperature as the 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. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring 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.

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 exposed 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.
   1. Apply 3 coats and buff to provide semi-gloss finish

END OF SECTION

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Resilient base.
2. Resilient stair accessories.
3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

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. Furnish not less than [10 linear feet (3 linear m)] <Insert dimension> for every [500 linear feet (150 linear m)] <Insert dimension> or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 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).

1.6 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 time 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

A. Resilient Base:
1. Manufacturers: Subject to compliance with requirments, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Armstrong World Industries, Inc.
b. Flexco, Inc.
c. Johnsonite.
d. Nora Rubber Flooring: Freudenberg Building System, Inc.
e. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
1. Style and Location:
a. Style A, Straight: Provide in areas with carpet.
b. Style B, Cove: Provide in areas with resilient flooring.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm), 6 inches (152 mm), As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Colors: As selected by Architect from full range of industry colors.

2.2 RUBBER STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Stair Treads: ASTM F 2169.
1. Type: TS (rubber, vulcanized thermoset).
2. Class: 1 (smooth, flat) 2 (pattern; embossed, grooved, or ribbed).
3. Group: 1 (embedded abrasive strips)] [2 (with contrasting color for the visually impaired).
4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
5. Nosing Height: 1-1/2 inches (38 mm).
6. Thickness: 1/4 inch (6 mm) and tapered to back edge.
7. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.

C. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
1. Style: Coved toe, 7 inches (178 mm) high by length matching treads.
2. Thickness: 0.125 inch (3.2 mm).

D. Stringers: Height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
1. Thickness: 0.125 inch (3.2 mm).

E. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

F. Locations: Provide rubber stair accessories in areas indicated.

G. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 RUBBER MOLDING ACCESSORY

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. Flexco, Inc.
2. Johnsonite.
3. Roppe Corporation, USA.

B. Description: Rubber carpet edge for glue-down applications nosing for carpet nosing for resilient flooring, reducer strip for resilient flooring joiner for tile and carpet, transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. 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.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

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. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
   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 manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
      a. Perform anhydrous calcium chloride test according to ASTM F 1869. 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).
      b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

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 resilient products until they are the same temperature as the 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.

E. 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 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:
1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 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 exposed 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.

END OF SECTION

SECTION 09 9113

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 surface preparation and the application of paint systems on the following exterior substrates:
   1. Concrete.
   2. Concrete masonry units (CMUs).
   3. Steel and iron.
   4. Galvanized metal.
   5. Aluminum (not anodized or otherwise coated).
   6. Wood.
   7. Portland cement plaster (stucco).

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
   2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
   3. Section 055213 "Pipe and Tube Railings" for shop [priming] [painting] pipe and tube railings.
   4. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 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 preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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, provide products by one of the following:
   1. Benjamin Moore & Co.
   2. Dulux (formerly ICI Paints); a brand of AkzoNobel.
   3. Farrell Calhoun.
   4. PPG Architectural Finishes, Inc.
   5. Pratt & Lambert.
   6. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
   7. Sherwin-Williams; Paint Stores Group.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

D. 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. Fiber-Cement Board: 12 percent.
   3. Masonry (Clay and CMUs): 12 percent.
   4. Wood: 15 percent.
   5. Portland Cement Plaster: 12 percent.
   6. Gypsum Board: 12 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Exterior 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 in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

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.

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. Wood Substrates:
1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
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.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
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.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
1. Latex System MPI EXT 3.1K:
a. Prime Coat: Latex, exterior, matching topcoat.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

B. CMU Substrates:
1. Latex System MPI EXT 4.2A:
a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

C. Steel and Iron Substrates:
1. Quick-Dry Enamel System MPI EXT 5.1A:
a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
c. Topcoat: Alkyd, quick dry, semi-gloss (MPI Gloss Level 5), MPI #81.
2. Aluminum Paint System MPI EXT 5.1K:
a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
b. Intermediate Coat: Aluminum paint, matching topcoat.
c. Topcoat: Aluminum paint, MPI #1.

D. Galvanized-Metal Substrates:
   1. Latex System MPI EXT 5.3H:
      a. Prime Coat: Primer, galvanized, water based, MPI #134.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

E. Aluminum Substrates:
   1. Latex System MPI EXT 5.4H:
      a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

F. Wood Substrates: Wood-based panel products.
   1. Latex over Latex Primer System MPI EXT 6.4K:
      a. Prime Coat: Primer, latex for exterior wood, MPI #6.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

G. Portland Cement Plaster Substrates:
   1. Latex System MPI EXT 9.1A:
      a. Prime Coat: Latex, exterior, matching topcoat.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

END OF SECTION

SECTION 09 9123

INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Concrete.
   2. Concrete masonry units (CMUs).
   3. Steel and iron.
   4. Galvanized metal.
   5. Aluminum (not anodized or otherwise coated).
   6. Wood.
   7. Gypsum board.
   8. Plaster.
   9. Cotton or canvas insulation covering.
   10. ASJ insulation covering.

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
   2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
   3. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
   4. Section 055213 "Pipe and Tube Railings" for shop [priming] [painting] pipe and tube railings.
   5. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in 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.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 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 preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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 when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Benjamin Moore & Co.
   2. Dulux (formerly ICI Paints); a brand of AkzoNobel.
   3. Farrell Calhoun.
   4. PPG Architectural Finishes, Inc.
   5. Pratt & Lambert.
   6. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
   7. Sherwin-Williams; Paint Stores Group.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. 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. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

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. 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.

G. 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.

H. Aluminum Substrates: Remove loose surface oxidation.

I. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      h. Other items as directed by Architect.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
   1. Latex System MPI INT 3.1E:
      a. Prime Coat: Latex, interior, matching topcoat.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

B. CMU Substrates:
   1. Latex System MPI INT 4.2A:
      a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

C. Steel Substrates:
   1. Water-Based Dry-Fall System MPI INT 5.1C:
      a. Prime Coat: Shop primer specified in Section where substrate is specified.
      b. Topcoat: Dry fall, latex (MPI Gloss Level 3), MPI #155.
   2. Quick-Dry Enamel System MPI INT 5.1A:
      a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.

b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
c. Topcoat: Alkyd, quick dry, semi-gloss (MPI Gloss Level 5), MPI #81.

D. Galvanized-Metal Substrates:
1. Latex System MPI INT 5.3J:
a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
1. Latex System MPI INT 5.4H:
a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

F. Wood Substrates: Wood trim, Architectural woodwork, and Doors.
1. Latex over Latex Primer System MPI INT 6.3T:
a. Prime Coat: Primer, latex, for interior wood, MPI #39.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

G. Wood Substrates: Wood paneling and casework.
1. Latex over Latex Primer System MPI INT 6.4R:
a. Prime Coat: Primer, latex, for interior wood[, MPI #39].
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

H. Gypsum Board and Plaster Substrates:
1. Latex over Latex Sealer System MPI INT 9.2A:
a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

I. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.
1. Latex System MPI INT 10.1A:
a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.

END OF SECTION

SECTION 10 1100

VISUAL DISPLAY UNITS

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. Visual display board assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.
1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:
1. Samples of facings for each visual display panel type, indicating color and texture.
2. Fabric swatches of fabric facings for tackboards.
3. Actual factory-finish color samples, applied to aluminum substrate.

D. Samples for Verification: For each type of visual display unit indicated.
1. Visual Display Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch- (150-mm-) long sections of each trim profile.
3. Display Rail: 6-inch- (150-mm-) long section of each type.
4. Accessories: Full-size Sample of each type of accessory.

E. Product Schedule: For visual display units.[Use same designations indicated on Drawings.]

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 VISUAL DISPLAY BOARD ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. A-1 Visual Systems.
2. AARCO Products, Inc.
3. ADP Lemco.
4. Architectural School Products Ltd.
5. Aristocrat Industries, Inc.
6. Aywon.
7. Bangor Cork Company, Inc.
8. Best-Rite; MooreCo, Inc.
9. Claridge Products and Equipment, Inc.
10. Egan Visual Inc.
11. EverWhite.
12. Ghent Manufacturing, Inc.
13. Marsh Industries, Inc.
14. Newline Products, Inc.
15. Peter Pepper Products, Inc.
16. Platinum Visual Systems.

B. Visual Display Board Assembly: Factory fabricated.
1. Assembly: Markerboard and tackboard.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
1. Color: As selected by Architect from full range of industry colors.

D. Tackboard Panel: Vinyl-fabric-faced tackboard panel on core indicated.
1. Color and Pattern: As selected by Architect from full range of industry colors.

E. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape.
   1. Aluminum Finish: Clear anodic finish.

F. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

G. Chalktray: Manufacturer's standard; continuous.
   1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

H. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
   1. Size: 2 inches (50 mm) high by full length of visual display unit.
   2. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1200 mm) of display rail or fraction thereof.
   3. Tackboard Insert Color: As selected by Architect from full range of industry colors.
   4. Aluminum Color: Match finish of visual display assembly trim.

2.4 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
   1. Particleboard Core: 3/8 inch (9.5 mm); with 0.005-inch- (0.127-mm-) thick, aluminum foil backing.
   2. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.5 TACKBOARD PANELS

A. Tackboard Panels:
   1. Facing: Vinyl fabric factory laminated 1/4-inch- (6-mm-) thick cork sheet.
   2. Core: 1/4-inch- (6-mm-) thick hardboard.

2.6 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

C. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, weighing not less than 13 oz./sq. yd. (440 g/sq. m); with surface-burning characteristics indicated.

D. Hardboard: ANSI A135.4, tempered.

E. Particleboard: ANSI A208.1, Grade M-1.

F. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

G. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.7 GENERAL FINISH REQUIREMENTS

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 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.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display units.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
   1. Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalktray.
   2. Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalktray.
   3. Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalktray.

3.4 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Panel signs.

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
   3. Division 23 Section "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
   4. Division 26 Sections for electrical service and connections for illuminated signs.
   5. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
   6. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for signs.

   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
   1. Aluminum.
   2. Acrylic sheet.
   3. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Dimensional Characters: Full-size Samples of each type of dimensional character (letter, number, and graphic element).
2. Aluminum: For each form, finish, and color, on 6-inch- long sections of extrusions and squares of sheet at least 4 by 4 inches.
3. Acrylic Sheet: 8 by 10 inches for each color required.
4. Accessories: Manufacturer's full-size unit.

E. Sign Schedule: Use same designations indicated on Drawings.

F. Qualification Data: For Installer and fabricator.

G. Maintenance Data: For signs to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in- service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Deterioration of metal and polymer finishes beyond normal weathering.
   b. Deterioration of embedded graphic image colors and sign lamination.
2. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

B. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure- sensitive adhesive backing, suitable for exterior applications.

2.2 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. ACE Sign Systems, Inc.
   2. Advance Corporation; Braille-Tac Division.
   3. Allen Industries Architectural Signage
   4. Allenite Signs; Allen Marking Products, Inc.
   5. APCO Graphics, Inc.
   6. ASI-Modulex, Inc.
   7. Best Sign Systems Inc.
   8. Bunting Graphics, Inc.
   9. Fossil Industries, Inc.
   10. Gemini Incorporated.
   11. Grimco, Inc.
   12. Innerface Sign Systems, Inc..
   13. InPro Corporation.
   14. Matthews International Corporation; Bronze Division.
   15. Mills Manufacturing Company.
   16. Mohawk Sign Systems.
   17. Nelson-Harkins Industries.
   18. Seton Identification Products.
   19. Signature Signs, Incorporated.
   20. Supersine Company (The)

B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:
   1. Acrylic Sheet: 0.060 inch thick.
   2. Laminated Sheet: High-pressure engraved stock with contrasting color face laminated to acrylic core as selected by Architect from manufacturer's full range.
   3. Laminated, Sandblasted Polymer: Raised graphics with Braille 1/32 inch above surface with contrasting colors as selected by Architect from manufacturer's full range and laminated to acrylic back.
   4. Edge Condition: Square cut.
   5. Corner Condition: Square.
   6. Mounting: Unframed.
      a. Wall mounted with two-face tape.
      b. Manufacturer's standard anchors for substrates encountered.
   7. Color: As selected by Architect from manufacturer's full range.
   8. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

C. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.
   1. Furnish insert material and software for creating text and symbols for PC-Windows computers for Owner production of paper inserts.
   2. Furnish insert material cut-to-size for changeable message insert.

D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
   1. Panel Material: Clear acrylic sheet with opaque color coating, subsurface applied.
   2. Raised-Copy Thickness: Not less than 1/32 inch.

E. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
   1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
   2. Engraved Metal: Fill engraved copy with enamel.
   3. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.
   4. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with enamel. Apply opaque background color coating to back face of acrylic sheet.

F. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
   1. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.
   1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
   2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
   3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
   4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.5 FINISHES, GENERAL

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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

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

3.2 INSTALLATION

A. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
   2. Shim Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
   3. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.4 SCHEDULE (See drawings for sign type location, sign number, and sign name)

A. Type 1 - 9”x6” Provide a total of 3 lines of graphics plus Braille.

END OF SECTION

SECTION 10 4413

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.

B. Related Requirements:
   1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets. 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 whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 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 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   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. American Specialties, Inc.
      b. Guardian Fire Equipment, Inc.
      c. JL Industries, Inc.; a division of the Activar Construction Products Group.
      d. Kidde Residential and Commercial Division.
      e. Larsens Manufacturing Company.
      f. Nystrom, Inc.
      g. Potter Roemer LLC.
      h. Strike First Corporation of America.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

D. 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. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Acrylic sheet.
   1. Acrylic Sheet Color: Clear transparent acrylic sheet.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide recessed door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire-protection cabinet with the words "**FIRE EXTINGUISHER**."
         1) Location: Applied to cabinet glazing.
         2) Application Process: Silk-screened.
         3) Lettering Color: White.
         4) Orientation: Vertical.

K. Materials:
   1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
      a. Finish: Baked enamel or powder coat.
      b. Color: As selected by Architect from full range of industry colors and color densities.

2. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.3 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. Provide factory-drilled mounting holes.
3. Install door catches and 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. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 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 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 walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. 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

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

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

SECTION 10 4416

FIRE EXTINGUISHERS

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

B. Related Requirements:
1. Section 104413 "Fire Protection Cabinets."

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 COORDINATION

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

1.7 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.
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.

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 products by one of the following:
a. Amerex Corporation.
b. Ansul Incorporated; Tyco International.
c. Guardian Fire Equipment, Inc.
d. JL Industries, Inc.; a division of the Activar Construction Products Group.
e. Kidde Residential and Commercial Division.
f. Larsens Manufacturing Company.
g. Potter Roemer LLC.
h. Pyro-Chem; Tyco Fire Suppression & Building Products.
i. Strike First Corporation of America.
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (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

SECTION 11 5200

AUDIO VISUAL EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrically operated, surface mounted, short throw projector.

1.2 RELATED SECTIONS

A. Division 16 for electrical wiring.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data : Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods..

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of equipment required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of flat screen panels with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver units until building is enclosed and other construction where screens will be installed is substantially complete.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect screens from damage during delivery, handling, storage, and installation.

1.6 COORDINATION

A. Coordinate work with installation of ceilings, walls, electric service power characteristics, and location.

PART 2 PRODUCTS

2.1 WALL MOUNTED SHORT THROW LCD SMART PROJECTOR

A. Basis-of Design Product:
   1. Manufacturer: Epson
      a. Model: 585Wi Interactive WXGA 3LCD Projector
      b. Basic Specifications.

Projection System: 3LCD, 3-chip technology

Projection Method: Front/rear/wall mount/table

Driving Method: Poly-silicon TFT Active Matrix

Pixel Number: 1,024,000 dots (1280 x 800) x 3

Color Brightness (Color Light Output): 3300 lumens[1]

White Brightness (White Light Output): 3300 lumens[1]

Interactive Color Brightness (Color Light Output): 3300 lumens[1]

Interactive White Brightness (White Light Output): 3300 lumens[1]

Aspect Ratio: 16:10

Native Resolution: 1280 x 800 (WXGA)

Lamp Type: E-TORL™ 245 W UHE

Lamp Life:

- ECO mode: Up to 6,000 hours[2]
- Normal mode: Up to 4,000 hours[2]

Throw Ratio Range:

- (4:3) 0.33 – 0.44
- (16:10) 0.27 – 0.37
- (16:9) 0.27 – 0.37

Size (projected distance):

- (4:3) 53" – 88"
- (16:10) 60" – 100"
- (16:9) 59" – 97"

Keystone Correction:

Manual:

- Vertical: ±3 degrees
- Horizontal: ±3 degrees

USB Plug 'n Play:

- Mac OS® 10.5 / 10.6 / 10.7 / 10.8 / 10.9
- Windows 2000 XP / Windows Vista® / Windows 7 / Windows 8

Contrast Ratio: Up to 10,000:1

Color Reproduction: Up to 1.07 billion colors

Color Processing: 10 bit
Display Performance:

- NTSC: 480 lines
- PAL: 576 lines

(Depends on observation of the multi burst pattern)

Input Signal: NTSC / NTSC4.43 / PAL / M-PAL / N-PAL / PAL60 / SECAM

Interfaces:

- HDMI x1
- HDMI/MHL x1
- Computer / Component video: D-sub 15 pin x 2
- S-video: Mini DIN x 1
- Composite video: RCA (Yellow) x 1
- Audio in: Mini stereo x 3
- USB connector: Type B x 1 (USB display, audio and mouse control)
- USB connector: Type A x 1 (USB memory / document camera)
- RJ-45 x 1
- Serial: RS-232c x 1
- Monitor Out: D-sub 15 pin x 1
- Audio out: Mini stereo x 1
- Microphone: Mini stereo x 1
- Wireless LAN port: 802.11 b/g/n (optional – module sold separately)
- Interactive Synchronization Mini stereo In
- Interactive Synchronization Mini stereo Out

Speaker: 16 W mono

Operating Temperature: 41° to 95° F (5° C to 35° C)

Power Supply Voltage: 100 – 240V ±10%, 50 / 60Hz

Power Consumption:

- Normal mode: 376 W
- Communication on: 4.3 W standby
- Communication off: 0.33 W standby

Fan Noise:

- ECO mode: 28 dB
- Normal mode: 35 dB

Security:

- Kensington® lock provision
- Security anchor bar
- Password protection function

- **Type of Interactive Input Device:** Digital Pen
- **Interactive Pen Functions:** Mouse functions (left and right click), Electronic pen, LED battery status indicator
- **Interactive Pen Power:** AA battery, rechargeable
- **Compatible Pen Battery Types:** SANYO Eneloop® HR-3UTG/HR-UTGA (Eneloop batteries included. Eneloop is registered trademark of Sanyo Electronic Co. Ltd., Manganese dry cell, alkaline dry cell
- **Interactive Pen Dimensions:** 6.4" x 0.94"
- **Interactive Pen Weight:** 1.1 oz (without battery)

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until all spaces are complete and substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install wall mounts in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and install monitor.

C. Test to verify that screen, controls and other operating components are in optimum functioning condition.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 2113

HORIZONTAL LOUVER BLINDS

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. Horizontal louver blinds with polymer slats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.

C. Samples for Initial Selection: For each type and color of horizontal louver blind.
1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type and color of horizontal louver blind indicated.
1. Slat: Not less than 12 inches (300 mm) long.
2. Tapes: Full width, not less than 6 inches (150 mm) long.
3. Horizontal Louver Blind: Full-size unit, not less than 16 inches (400 mm) wide by 24 inches (600 mm) long.
4. Valance: Full-size unit, not less than 12 inches (300 mm) wide.

E. Window-Treatment Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of horizontal louver blind.

B. Product Test Reports: For each type of horizontal louver blind, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.6 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. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than four units.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, POLYMER SLATS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Comfortex Window Fashions.
   2. Hunter Douglass Contract.
   3. Levolor Contract; a Newell Rubermaid brand.
   4. SWFcontract; Springs Window Fashions, LLC.

B. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Slats: Polymers that are lead free, UV stabilized, integrally colored, opaque, and will not crack or yellow; antistatic, dust-repellent treated.
   1. Formulation: Permanently flexible, extruded PVC.
   2. Width: 2 inches (51 mm).
   3. Thickness: 0.125 inch (3.2 mm).
   4. Spacing: Manufacturer's standard.
   5. Profile: Crowned.

D. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrail fully encloses operating mechanisms on three sides and ends.
   1. Capacity: One blind per headrail unless otherwise indicated.
   2. Manual Lift Mechanism:
      a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within full operating range.
      b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.
   3. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
      a. Tilt: Full.
      b. Operator: Clear-plastic wand.
      c. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.
   4. Manual Lift-Operator and Tilt-Operator Lengths: Manufacturer's standard.
   5. Manual Lift-Operator and Tilt-Operator Locations: Manufacturer's standard unless otherwise indicated.

E. Bottom Rail: Secures and protects ends of ladders and lift cords.
   1. Type: Formed-steel or extruded-aluminum tube, with plastic or metal capped ends.

F. Lift Cord: Manufacturer's standard braided cord.

G. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.

H. Valance: Manufacturer's standard.

I. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
   1. Type: End.
   2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

J. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

K. Colors, Textures, Patterns, and Gloss:
   1. Slats: As selected by Architect from manufacturer's full range.
   2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

2.3 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
   1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish:
   1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
   1. Locate so exterior slat edges are not closer than 2 inches (51 mm) from interior faces of glass and not closer than 1-1/2 inches (38 mm) from interior faces of glazing frames through full operating ranges of blinds.
   2. Install mounting and intermediate brackets to prevent deflection of headrails.
   3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION

SECTION 21 0000

FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following fire-suppression piping inside the building:
   1. Wet-pipe sprinkler systems.

1.2 RELATED DOCUMENTS

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

B. DIVISION 26 - for alarm devices not specified in this Section.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene - propylene - diene terpolymer rubber.

C. PE: Polyethylene plastic.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. These documents provide performance criteria for the design of the fire suppression sprinkler systems.

B. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).

C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
   1. Margin of Safety for Available Water Flow and Pressure: 10psig (69kPa), including losses through water-service piping, valves, and backflow preventers.
   2. Sprinkler Occupancy Hazard Classifications:
      a. Building Service Areas: Ordinary Hazard, Group 1.
      b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      c. General Storage Areas: Ordinary Hazard, Group 1.
      d. Classroom, Office and Public Areas: Light Hazard.
   3. Minimum Density for Automatic-Sprinkler Piping Design:
      a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.
      b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (9.5 mL/s over 139-sq. m) area.
   4. Maximum Protection Area per Sprinkler:
      a. Office Spaces: 225 sq. ft. (20.9 sq. m).
      b. Storage Areas: 130 sq. ft. (12.1 sq. m).

c. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
d. Other Areas: According to NFPA 13 recommendations, Factory Mutual as well as FM Global requirements unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 and Factory Mutual Global, unless otherwise indicated:
   a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.

D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to Factory Mutual Global, NFPA 13 and local building codes.

1.6 SUBMITTALS

A. Product Data: For the following:
1. Piping materials, including sprinkler specialty fittings.
2. Pipe hangers and supports, including seismic restraints.
3. Valves, including listed fire-protection valves, and unlisted general-duty valves.
4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
5. Alarm devices, including electrical data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to Factory Mutual Global requirements and NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13, and Factory Mutual Global. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Welding certificates.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems. Base calculations on results of fire-hydrant flow test.
   a. Designer Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

D. FM Global Standard: Fire suppression system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. Data Sheet 2-0, “Installation guidelines for automatic sprinklers.

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.
   1. Cast-Iron Threaded Flanges: ASME B16.1.
   2. Malleable-Iron Threaded Fittings: ASME B16.3.
   3. Gray-Iron Threaded Fittings: ASME B16.4.
   4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
   5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250).
   1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
   2. Steel Flanges and Flanged Fittings: ASME B16.5.

C. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250); with factory- or field-formed, roll-grooved ends.
   1. Grooved-Joint Piping Systems:
      a. Manufacturers:
         (1) Central Sprinkler Corp.
         (2) Star Pipe Products; Star Fittings Div.
         (3) Victaulic Co. of America.
      b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
      c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

2.5 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be FM Global approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping.

B. Outlet Specialty Fittings:
   1. Manufacturers:
      a. Central Sprinkler Corp.
      b. Star Pipe Products; Star Fittings Div.
      c. Victaulic Co. of America.
   2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.
   1. Manufacturers:
      a. Central Sprinkler Corp.
      b. Fire-End and Croker Corp.
      c. Viking Corp.
      d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
   1. Manufacturers:
      a. Elkhart Brass Mfg. Co., Inc.
      b. Fire-End and Croker Corp.
      c. Potter-Roemer; Fire-Protection Div.

2.6 LISTED FIRE-PROTECTION VALVES

A. Valves shall be Factory Mutual Global approved, with 175-psig (1200 kPa) minimum pressure rating.

B. Gate Valves with Wall Indicator Posts:
   1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
   2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.
   3. Manufacturers:
      a. Grinnell Fire Protection.
      b. McWane, Inc.; Kennedy Valve Div.
      c. NIBCO.
      d. Stockham.

C. Ball Valves: Comply with UL 1091, except with ball instead of disc.
   1. NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
   2. NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
   3. NPS 3 (DN 80): Ductile-iron body with grooved ends.
   4. Manufacturers:
      a. NIBCO.
      b. Victaulic Co. of America.

D. Butterfly Valves: UL 1091.
   1. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
      a. Manufacturers:
         (1) Central Sprinkler Corp.
         (2) McWane, Inc.; Kennedy Valve Div.
         (3) Mueller Company.
         (4) NIBCO.
         (5) Victaulic Co. of America.

E. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
   1. Manufacturers:
      a. American Cast Iron Pipe Co.; Waterous Co.
      b. Central Sprinkler Corp.
      c. Clow Valve Co.
      d. Crane Co.; Crane Valve Group; Crane Valves.
      e. Crane Co.; Crane Valve Group; Jenkins Valves.
      f. Globe Fire Sprinkler Corporation.
      g. Grinnell Fire Protection.
      h. Hammond Valve.
      i. McWane, Inc.; Kennedy Valve Div.
      j. Mueller Company.
      k. NIBCO.
      l. Potter-Roemer; Fire Protection Div.
      m. Reliable Automatic Sprinkler Co., Inc.
      n. Star Sprinkler Inc.
      o. Stockham.
      p. Victaulic Co. of America.
      q. Watts Industries, Inc.; Water Products Div.

F. Gate Valves: UL 262, OS&Y type.
   1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
      a. Manufacturers:
         (1) Crane Co.; Crane Valve Group; Crane Valves.
         (2) Hammond Valve.
         (3) NIBCO.

2. NPS 2-1/2 (DN 65) and Larger: Cast-iron body with flanged ends.
   a. Manufacturers:
      (1) Clow Valve Co.
      (2) Crane Co.; Crane Valve Group; Crane Valves.
      (3) Crane Co.; Crane Valve Group; Jenkins Valves.
      (4) Hammond Valve.
      (5) Milwaukee Valve Company.
      (6) Mueller Company.
      (7) NIBCO.

G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
   1. Indicator: Visual.
   2. NPS 2 (DN 50) and Smaller: Ball or butterfly valve with bronze body and threaded ends.
      a. Manufacturers:
         (1) Milwaukee Valve Company.
         (2) NIBCO.
         (3) Victaulic Co. of America.
   3. NPS 2-1/2 (DN 65) and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
      a. Manufacturers:
         (1) Central Sprinkler Corp.
         (2) Grinnell Fire Protection.
         (3) McWane, Inc.; Kennedy Valve Div.
         (4) Milwaukee Valve Company.
         (5) NIBCO.
         (6) Victaulic Co. of America.

2.7 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 (DN 50) and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

2.8 SPRINKLERS

A. Sprinklers shall be Factory Mutual Global approved, with 175-psig (1200-kPa) minimum pressure rating.

B. Manufacturers:
   1. Central Sprinkler Corp.
   2. Globe Fire Sprinkler Corporation.
   3. Grinnell Fire Protection.
   4. Reliable Automatic Sprinkler Co., Inc.
   5. Star Sprinkler Inc.
   6. Victaulic Co. of America.
   7. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:
   1. UL 199, for nonresidential applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:
   1. Recessed ceiling sprinklers, including cover plate.
   2. Quick-response sprinklers.
   3. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections and compatible with fire alarm system. Coordinate with Fire Alarm Contractor..

B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig (1725-kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
   1. Manufacturers:
      a. ADT Security Services, Inc.
      b. Grinnell Fire Protection.
      c. ITT McDonnell & Miller.
      d. Potter Electric Signal Company.
      e. System Sensor.
      f. Viking Corp.
      g. Watts Industries, Inc.; Water Products Div.

C. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
   1. Manufacturers:
      a. McWane, Inc.; Kennedy Valve Div.
      b. Potter Electric Signal Company.
      c. System Sensor.

2.10 PRESSURE GAGES

A. Manufacturers:
   1. AMETEK, Inc.; U.S. Gauge.
   2. Dresser Equipment Group; Instrument Div.

B. Description: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 250 psig (0 to 1725 kPa) minimum.
   1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
   2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14, and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article. Flow test shall be no more than 120-days old at date of first submittal.

B. Report test results promptly and in writing.

3.2 EARTHWORK

A. Refer to Division 02 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

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

3.4 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig (1200-kPa) Maximum Working Pressure:
   1. Sprinkler-Piping Fitting Option: Specialty sprinkler fittings, NPS 2 (DN 50) and smaller, may be used downstream from sprinkler zone valves.
   2. NPS 2 (DSN 50)and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
   3. NPS 2-1/2 (DN 65) and Larger: Plain-end, Schedule 10 steel pipe; steel welding fittings; and welded joints.
   4. NPS 2-1/2 (DN 65) and Larger: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.6 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Listed Fire-Protection Valves: Factory Mutual Global Requirements approved for applications where required by NFPA 13, NFPA 14 or Factory Mutual Global.
      a. Shutoff Duty: Use ball, butterfly, or gate valves.
   2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
      a. Shutoff Duty: Use ball, butterfly, or gate valves.
      b. Throttling Duty: Use ball valves.

3.7 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13, and Factory Mutual Global for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
   1. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

3.8 PIPING INSTALLATION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install drain valves on standpipes.

I. Install alarm devices in piping systems.

J. Hangers and Supports: Comply with NFPA 13 and Factory Mutual Global for hanger materials.
   1. Install standpipe system piping according to NFPA 14 and Factory Mutual Global.
   2. Install sprinkler system piping according to NFPA 13 and Factory Mutual Global.

K. Earthquake Protection: Install piping according to Factory Mutual Global Data Sheet 2-8 to protect from earthquake damage.

L. Fill wet-pipe sprinkler system piping with water.

3.9 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13, NFPA 14, Factory Mutual Global, and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

3.10 SPRINKLER APPLICATIONS

A. Use the following sprinkler types:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: recessed sprinklers.
   3. Special Applications: Quick-response throughout.
   4. Sprinkler Finishes:
      a. Upright, Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
      b. Recessed Sprinklers: Chrome plated.

3.11 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension and at 1-foot intervals on the long dimension of acoustical ceiling panels and tiles.

3.12 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Electrical Connections: Power wiring is specified in Division 26.

D. Connect alarm devices to fire alarm.

E. Ground equipment according to Division 26.

F. Connect wiring according to Division 26.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.13 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 22 Section "Plumbing Identification."

3.14 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Energize circuits to electrical equipment and devices.
   4. Flush, test, and inspect sprinkler systems according to NFPA 13.
   5. Coordinate with fire alarm tests. Operate as required.
   6. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.15 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.16 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01.

END OF SECTION

SECTION 22 0510

BASIC PLUMBING MATERIALS AND METHODS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Sleeves.
   5. Escutcheons.
   6. Grout.
   7. Equipment installation requirements common to equipment sections.
   8. Painting and finishing.
   9. Supports and anchorages.

1.2 RELATED SECTIONS

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

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
   1. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Equipment: Electrical characteristics of equipment shall be as indicated on drawings. Contractor shall verify that connecting electrical services furnished by Division 16 Contractor match equipment requirements. Contractor shall notify Engineer of any discrepancies for resolution prior to ordering equipment. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for installation.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
   1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   1. Manufacturers:
      a. Dresser Industries, Inc.; DMD Div.
      b. JCM Industries.
   2. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
   3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
   1. Manufacturers:
      a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
   1. Manufacturers:
      a. NIBCO INC.
      b. NIBCO, Inc.; Chemtrol Div.

D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
   1. Manufacturers:
      a. Fernco, Inc.
      b. Mission Rubber Company.
      c. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035 kPa) minimum working pressure as required to suit system pressures.
   1. Manufacturers:
      a. Epco Sales, Inc.
      b. Watts Industries, Inc.; Water Products Div.

D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Pipeline Seal and Insulator, Inc.
   2. Separate companion flanges and steel bolts and nuts shall be rated for minimum 150 psig (1035 kPa) minimum working pressure where required to suit system pressures.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and rated for minimum 300-psig (2070-kPa) working pressure at 225 deg F (107 deg C).
   1. Manufacturers:
      a. Precision Plumbing Products, Inc.
      b. Sioux Chief Manufacturing Co., Inc.
      c. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Metraflex Co.
      c. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Stainless steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. The installing contractor shall examine the pipe and fittings for defects or cracks. There shall be no defects of the pipe or fittings. Any damaged pipe or fittings shall be rejected.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved by the Engineer.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at required slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections, unless specified otherwise.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Pipe Protection: Provide protection against abrasion where copper tubing is in contact with other building members by wrapping with an approved tape or pipe insulation.

M. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   2. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with polished chrome-plated finish.

N. Sleeves are not required for core-drilled holes.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Cast Iron Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
      b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
         (1) Seal space outside of sleeve fittings with grout.
   4. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
   3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of systems, equipment, and components is specified in Division 09.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 22 0529

PLUMBING HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following hangers and supports for system piping and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Pipe stands.
   7. Pipe positioning systems.
   8. Equipment supports.

1.2 RELATED SECTIONS

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

B. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. Division 21 for pipe hangers for fire-protection piping.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Powder-actuated fastener systems.
   4. Pipe positioning systems.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."

2. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:
   1. B-Line Systems, Inc.; a division of Cooper Industries.
   2. Grinnell Corp.
   3. National Pipe Hanger Corporation.
   4. Tolco Inc.

C. Galvanized, Metallic Coatings: hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
   1. B-Line Systems, Inc.; a division of Cooper Industries.
   2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
   3. Power-Strut Div.; Tyco International, Ltd.
   4. Thomas & Betts Corporation.
   5. Tolco Inc.
   6. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:
   1. Carpenter & Paterson, Inc.
   2. ERICO/Michigan Hanger Co.

3. Pipe Shields, Inc.

C. Insulation-Insert Material: ASTM C 552, Type II cellular glass with vapor barrier.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers:
a. Hilti, Inc.
b. ITW Ramset/Red Head.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers:
a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Hilti, Inc.
c. ITW Ramset/Red Head.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:
1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS ½ to NPS 30 (DN 15 to DN 750).
   2. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS ½ to NPS 8 (DN 15 to DN 200).
   3. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS ½ to NPS 2 (DN 15 to DN 50).
   4. U-Bolts (MSS Type 24): For support of heavy pipes, NPS ½ to NPS 30 (DN 15 to DN 750).
   5. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   6. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

G. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
   3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   4. C-Clamps (MSS Type 23): For structural shapes.
   5. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb (340 kg).
      b. Medium (MSS Type 32): 1500 lb (680 kg).
      c. Heavy (MSS Type 33): 3000 lb (1360 kg).
   6. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

H. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

I. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

J. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

K. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

L. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 for plumbing fixtures.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide required pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Use thermal-hanger shield insert with clamp sized to match OD of insert.
      b. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 40, protective shields on piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
   3. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
      c. NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
      d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
      e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
   4. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
   5. Insert Material: Length at least as long as protective shield.
   6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 0760

PLUMBING IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following plumbing identification materials and their installation:
   1. Pipe markers.

1.2 RELATED SECTIONS

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

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
   4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
   5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
   1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.

2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

2.2 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) and minimum letter height of 3/4 inch (19 mm) for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
   1. Stencil Material: Metal or fiberboard.
   2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
   3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.VALVE TAGS

B. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and ½-inch (13-mm) numbers, with numbering scheme approved by Architect. Provide 5/32 inch (4mm) hole for fastener.
   1. Material: 3/32-inch- (2.4-mm-) thick laminated plastic with 2 black surfaces and white inner layer.
   2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

PART 3 EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 22 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
   1. Pipes with OD, (Including Insulation), Less Than 6 Inches (150 mm): Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch (19 mm) wide to identify service, lapped at least 1-1/2 inches (38 mm) with separate flow direction indicator tape flow direction tape shall cover circumference of pipe.
   2. Pipes with OD, (Including Insulation), 6 Inches (150 mm) and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
   3. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches (38 mm) wide, identify service, lapped at least 3 inches (75 mm) flow direction tape shall cover circumference of pipe.

B. Locate pipe markers and color bands at locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal devices. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
   4. At access doors and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.
   8. One marker per system in each room, minimum.

3.3 ADJUSTING

A. Relocate plumbing identification materials and devices that have become visually blocked by other work.

3.4 CLEANING

A. Clean faces of plumbing identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 22 0840

PLUMBING PIPE INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes plumbing pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.2 RELATED SECTIONS

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

B. Division 07 for firestopping materials and requirements for penetrations through fire and smoke barriers.

C. Division 22 Section "Plumbing Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Plumbing Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

C. Coordinate installation and testing of electric heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mineral-Fiber Insulation:
      a. CertainTeed Manson.
      b. Knauf FiberGlass GmbH.
      c. Owens-Corning Fiberglas Corp.
   2. Flexible Elastomeric Thermal Insulation:
      a. Armstrong World Industries, Inc.
      b. Rubatex Corp.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
   1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
   2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
   3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
      a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
   5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.
   1. Adhesive: As recommended by insulation material manufacturer.
   2. PVC Jacket Color: White.
   3. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.

C. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-(0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.
   1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, and mechanical joints.
   2. Adhesive: As recommended by insulation material manufacturer.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
   1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19mm) wide, in 0.007 inch (0.18mm) thick aluminum.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

G. Keep insulation materials dry during application and finishing.

H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

I. Apply insulation with the least number of joints practical.

J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

K. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
   1. Apply insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
   3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

L. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

N. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
   3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
      a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
   4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
   5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

O. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

P. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
   1. Firestopping and fire-resistive joint sealers are specified in Division 07.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:
   1. Secure each layer of preformed pipe insulation to pipe with tape, or bands without deforming insulation materials.

2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:
1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 FIELD-APPLIED JACKET APPLICATION

A. Apply PVC jacket where indicated, with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

3.6 FINISHES

A. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.7 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
   1. Flexible connectors.
   2. Fire-suppression piping.
   3. Below-grade piping, unless otherwise indicated.
   4. Chrome-plated pipes and fittings, unless potential for personnel injury.
   5. Air chambers, unions, strainers, check valves and flow regulators.

3.8 FIELD QUALITY CONTROL

A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
   1. Inspect fittings and valves randomly selected by Architect.

B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.9 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.10 INSULATION APPLICATION SCHEDULE

A. Service: Condensate drain piping and other drain piping carrying condensate and subject to sweating.
   1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
   2. Insulation Material: Mineral fiber.
   3. Insulation Thickness: 1/2 inch (50mm) thick.
   4. Field-Applied Jacket: None.
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

END OF SECTION

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following for soil, waste, vent, and condensate piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.
   3. Encasement for underground metal piping.

1.2 RELATED SECTIONS

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

B. Division 23 Section “Chemical Waste Piping” for chemical waste and vent piping systems.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. NBR: Acrylonitrile-butadiene rubber.

D. PVC: Polyvinyl chloride plastic.

E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

B. Seismic Performance: Soil, waste, and vent piping and supports shall be capable of withstanding the effects of seismic events in accordance with code requirements.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:
   1. Design calculations: Signed and sealed by a qualified professional engineer for selecting seismic restaints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
      a. Manufacturers:
         (1) ANACO.
         (2) Fernco, Inc.
         (3) Mission Rubber Co.
         (4) Tyler Pipe; Soil Pipe Div.
   2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
      a. Manufacturers:
         (1) ANACO.
         (2) Clamp-All Corp.
         (3) Mission Rubber Co.
         (4) Tyler Pipe; Soil Pipe Div.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
   1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

B. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B, water tube, drawn temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
   2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
   3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.6 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers:
      a. Fernco, Inc.
      b. Mission Rubber Co.
      c. Plastic Oddities, Inc.
   2. Sleeve Materials:
      a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, LLDPE film of 0.008-inch (0.20-mm) minimum thickness.

B. Form: tube.

C. Color: Black or natural.

PART 3 EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Piping in plenum areas shall be metal, no plastic piping will be allowed.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Copper DWV tube, copper drainage fittings, and soldered joints.

D. Underground, soil, waste, and vent piping shall be solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 0.

B. Basic piping installation requirements are specified in Division 23 Section “Basic Plumbing Materials and Methods”.

C. Install seismic restraints on piping as required by code.

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Install piping true to grades and alignment, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste drainage and vent piping at the slopes required by Code.

I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section “Basic Plumbing Material and Methods”.

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 15 Section “Plumbing Hangers and Supports”. Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Install individual, straight, horizontal piping runs according to the following:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

B. Install supports according to Division 22 Section “Plumbing Hangers and Supports”.

C. Support vertical piping and tubing at base.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with ½-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

F. Install supports for vertical steel piping every 15 feet (4.5 m).

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with ½-inch (13-mm) rod.
   4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with ½-inch (13-mm) rod.

H. Install supports for vertical copper tubing every 10 feet (3 m).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Equipment: Connect drainage piping as indicated. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
   5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 23 0000

HVAC, BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Basic materials for support, access, and serviceability of heating, ventilating, and air conditioning system. Angle iron, pipe, "Unistrut" or other suitable steel auxiliary supports shall be provided as required for the HVAC work.
   1. Pipe and pipe fittings.
   2. Pipe hangers, inserts, supports, clamps, and sleeves.
   3. Escutcheons and flashings.
   4. Valves, vents, and strainers.

1.2 RELATED SECTIONS

A. Section 23 01 00 - GENERAL PROVISIONS, MECHANICAL.

B. Section 23 07 05 - HVAC INSULATION.

C. Section 23 31 00 - LOW VELOCITY DUCTWORK.

PART 2 PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. AC Drain Piping: Schedule 40 Type 1 rigid PVC pipe, and Schedule 40 Type 1 molded PVC socket fittings, and solvent welded joints, conforming to ASTM Standards D1785, D2466, and D2855 respectively.

B. Gas Piping: Schedule 40 black steel pipe, with 150 pound black malleable iron threaded fittings or Schedule 40 black steel butt welding fittings as applicable. Underground gas pipe shall be factory plastic coated, or mill coated and wrapped with hot enamel and felt, and its fittings and joints shall be field coated and wrapped with two half-lapped layers of Scotchwrap No. 50 plastic pipe coating tape, all in accordance with the applicable specifications of the Gas Utility Company.

2.2 PIPE HANGERS, SUPPORTS, CLAMPS, AND SLEEVES

A. Model numbers as Fee and Mason, unless otherwise indicated.

B. All hangers for piping shall be provided with a means of vertical adjustment.

C. Hangers for suspended horizontal pipes shall be split malleable iron ring, steel clevis, or other suitable standard adjustable type. Hangers or supports for pipes on walls, columns, and other vertical surfaces shall be split ring extension type. Hangers for copper tubing shall be copper plated. Perforated strap or band iron hangers will not be permitted.

D. Gas Piping Run on Roofs
   1. Gas pipe run on roofs will be supported by premanufactured pipe stands intended for such purpose. Wood supports, either treated or untreated are not permitted.
   2. Supports to be of corrosion and ultraviolet resistant material.
   3. Unit shall not be fastened to roof but will "float" with pipe expansion and contraction.

4. Acceptable Manufacturer: Model #02 for pipe sizes 3/4" and 1"; Model #24R for pipe size larger than 1".
   a. Miro Industries
   b. Murray, UT
   c. 801-566-3680

E. Where piping is to be supported from building steel, adjustable beam clamps shall be used.

F. Vertical piping shall be supported with riser clamps; figure 241 or 238.

G. Sleeves:
1. Sleeves through concrete construction; except slabs, shall be Schedule 40 black steel pipe.
2. Sleeves through slabs, except slabs on grade, where water on floor could pass through flush floor sleeves, shall be STANDING sleeves of Schedule 40 galvanized steel pipe.
3. Sleeves through masonry walls, partitions and other building construction shall be standard weight galvanized steel pipe.

2.3 ESCUTCHEONS AND FLASHINGS

A. Escutcheons shall be chrome plated metal with fastening devices.

B. Steel Flashing: 26 gauge galvanized steel.

C. Lead Flashing: 5 lb/sq ft sheet lead for waterproofing, 1 lb/sq ft sheet lead to soundproofing.

2.4 VALVES, STRAINERS, AND FITTINGS

A. Cut-off Valves, Gas: Rockwell lubricated tapered plug type with permanently attached operating wrench, figure 114 or 142 threaded or figure 143 flanged, as applicable.

B. Unions: For steel pipe, 150 pound black malleable iron brass-to-iron seat ground joint type; for copper tubing, all-brass ground joint or compression type.

C. Flanges: For gas pipe, 150 pound forged steel threaded, welding neck, or slip-on type, as applicable; for other steel pipe, 125 pound black cast iron threaded type, or 150 pound forged steel slip-on or welding neck type, as applicable.

PART 3 EXECUTION

3.1 PIPE AND PIPE FITTINGS

A. Install piping with ample flexibility to permit free expansion and contraction of pipework without putting any stress on the pipework, supports, and equipment which could cause damage or breakage. Branch connections to mains, risers, and laterals shall be swing type, except where length and arrangement of branch will provide sufficient flexibility. Remove loose scale and dirt from pipes and fittings before installing them. Install valves at locations indicated and/or specified below, each accessible, and where practicable operable by personnel standing on floor.

B. Reaming: After cutting, ream pipe ends to full pipe inside diameter.

C. Soldered and silver joints: Completely fill joint spaces with solder or silver brazing alloy, as applicable, without overheating or oxidizing pipe; use suitable non-corrosive flux on soft soldered joints.

D. Threaded Joints: Use suitable non-hardening pipe joint compound on male threads only, or use Teflon pipe joint tape.

E. Welded Joints: Turns and offsets of 15 degrees and less may be mitered; use welding elbows at all other turns, except where bent turns are indicated or approved; at each branch connection, use welding tee or "Weldolets: or butt weld saddled-end branch directly to main without branch end extending into inside of main; length of each job-fabricated reducer shall be not less than diameter of its larger end; use extra heavy threaded couplings or "Threadolets" where female threaded openings are required in pipes for gauges, thermometers, air vent valves, and similar devices.

F. AC Drain Lines: Make each turn of over 45 degrees with tees or crosses having accessible removable threaded cleanout plugs arranged so that entire line can be cleaned out.

3.2 INSERTS

A. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

B. Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over four inch or ducts over 60 inches wide.

C. Where concrete slabs form finished ceiling, finish inserts, flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.3 PIPE HANGERS, SUPPORTS, CLAMPS, AND SLEEVES

A. Place hangers or other supports within two feet or sufficiently near elbows, tees, risers, valves, and other items to provide adequate pipework support.

B. Secure each hanger to its hanger rod with supporting nuts under and/or locknut above the hanger; also provide the necessary diameter supporting rod as recommended by the manufacturer for the service involved and that matches the hanger involved. Support horizontal steel pipe and copper tubing as follows:

	STEEL PIPE		
NOM PIPE SIZE	MAX SPAN FT	NOM PIPE SIZE	MAX SPAN FT
1" - 1-1/4"	7	5	16
1-1/2"	9	6	17
2”	10	8	19
2-1/2”	11	10	22
3”	12	12	23
3-1/2”	13	14	25
4”	14	16	27

C. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

D. Where practical, support riser piping independently of connected horizontal piping.

E. Maximum floor support spacings for pipework shall be as specified in paragraph B above for hangers. In all cases, place floor supports at or sufficiently near elbows, tees, risers, valves, and other specialties to provide adequate pipework support.

F. Where piping is to be supported from building steel, beam clamps shall be used. Holes drilled in building steel for hanger support rods will not be permitted.

G. Sleeves through concrete construction, except slabs, shall be flush with finished concrete surfaces. Sleeves through slabs, except slabs on ground, where water on floor could pass through shall be extended two inches above floor and flush with slab bottom. Smoothly cut and ream steel pipe sleeve ends. Where each pipe above floor inside of building passes through wall into ground, completely caulk space between pipe and wall sleeve with suitable resilient non-hardening sealant to prevent water leakage into building.
   1. Firestop all openings around pipes and ducts which penetrate walls and floors, except slabs on grade, with U.L. Firestopping System.

H. In New Construction: Sleeves shall be cast-in-place or built-in-place as construction progresses.

3.4 ESCUTCHEONS AND FLASHINGS

A. Provide a pipe escutcheon where each exposed, uninsulated pipe passes through a finished wall or ceiling surface. Provide a rod escutcheon where each hanger rod passes through a finished ceiling surface. Escutcheons are not required in unfinished areas.

B. Provide a weatherproof flashing at each location where a pipe and where a duct passes through a roof or through an outside wall.

C. Flash and counterflash where mechanical equipment passes through weather or water proofed walls, floors, and roofs.

3.5 VALVES, STRAINERS, AND FITTINGS

A. Unions: Provide a union at each piping connection to each equipment item, and at other locations indicated and/or required. Each equipment item shall be removable from pipework by disconnecting adjacent or nearby unions. Install unions in convenient and accessible locations to facilitate removal equipment items and access to their interior parts by disconnecting only the unions, without disturbing cut-off valves and other piping upstream of unions for supplies and downstream of unions for returns. NOTE: Flanges and other disconnectable fittings may serve as unions.

END OF SECTION

SECTION 23 0100

GENERAL PROVISIONS, MECHANICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Mechanical work covered by all sections within DIVISION 23 - MECHANICAL of these Specifications, including but not limited to:
      a. Heating, ventilating, and air conditioning systems and equipment.
      b. Plumbing systems and equipment.
      c. Fire protection systems and equipment.

1.2 RELATED SECTIONS

A. DIVISION 03 - CONCRETE.

B. DIVISION 05 - METALS.

C. Division 07 - FIRESTOPPING.

D. DIVISION 09 - FINISHES.

E. DIVISION 23 - MECHANICAL.

F. DIVISION 26 - ELECTRICAL.

1.3 REFERENCE STANDARDS, CODES, FEES AND UTILITY CONNECTION CHARGES

A. Local codes.
B. International Building Codes.
C. State Codes.
D. FM - Factory Mutual.
E. Federal Codes.
F. ASME Boiler Code.
G. AGA - American Gas Association.
H. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
I. AABC - Associated Air Balance Council.
J. ADC - Air Diffusion Council.
K. IEEE - Institute of Electrical Electronic Engineers.
L. ANSI - American National Standards Institute.
M. ASME - American Society of Mechanical Engineers.
N. NEMA - National Electrical Manufacturer's Association.
O. NFPA - National Fire Protection Association.
P. ARI - Air-Conditioning and Refrigeration Institute.
Q. UL - Underwriters Laboratories, Inc.
R. NBC - National Building Code.
S. NMC - National Mechanical Code.
T. NPC - National Plumbing Code.
U. OSHA - Occupational Safety and Health Act.
V. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
W. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories (UL), proof of such conformance shall be submitted for

approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified.

X. The contractor shall obtain and pay for all licenses and permits required to perform work covered by DIVISION 23 - MECHANICAL, and obtain and pay for all necessary inspections by all applicable authorities.

Y. Contractor shall make arrangements with utility company(ies) for their services and metering work. Pay all charges therefor, and include the cost thereof in the contract price. For gas charges, Desoto County Schools shall pay any changes for meter or gas extension, directly to the “Mississippi Valley Association”.

1.4 QUALITY ASSURANCE

A. Supply all equipment and accessories new and free from defects.

B. Products Criteria:
   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least two years prior to bid opening. Provide list of users upon request.
   2. Equipment having less than a two year use record, which in the opinion of the Engineer, provides significant benefits to the Owner such as improved energy efficiency, will be acceptable if it is a product of a manufacturer who has been regularly engaged in the manufacture of that specific type of product which has been used in similar applications for a period of two years. The ENGINEER/ARCHITECT reserves the right to require the Contractor to submit evidence to this effect for his approval.
   3. Equipment Service: Products shall be supported by a service organization which maintains an adequate inventory of repair parts and is located, in the opinion of the ENGINEER/ARCHITECT, reasonably close to the site.
   4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
   5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
   6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

C. Welding: Before any welding is performed submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code.
   1. Before any welder performs any welding, submit a copy of the Manufacturer's Record of Welder or Welding Operator Qualification Tests as required by Section IX of the ASME Boiler and Pressure Vessel Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed in accordance with appropriate construction code, to each completed weld.
   2. The types and extent of non-destructive examinations required for pipe welds are shown in Table 136.4 of the Code for Pressure Piping, ANSI/ASME B31.1.

D. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with all applicable national, state, and local codes.

E. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished for record to the ENGINEER/ARCHITECT prior to installation. Installation of the item will not be allowed to

proceed until the recommendations are received. Failure to furnish these recommendations may be cause for rejection of the material.

F. When included, reflected ceiling plan drawings shall govern over mechanical and electrical drawings for location of ceiling-installed elements.

G. In addition to all requirements specified hereinafter, each material and equipment item shall have all features as standard with its manufacturer and/or required for the complete operational system.

H. Capacities, ratings, sizes, and other requirements not specified hereinafter shall be as scheduled or otherwise indicated on the drawings.

I. Should the Trade Contractor at any time discover a discrepancy in the drawings or with respect to a variance of code requirements, he shall notify the ENGINEER/ARCHITECT for clarification and shall not proceed with the work affected until clarification has been made.

1.5 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with these CONTRACT DOCUMENTS, Section 01 33 00 SUBMITTALS and in accordance with the following:
   1. Submit shop drawings, manufacturers data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and have them approved before procurement, fabrication, or delivery of the items to the job site. Partial submittals will not be acceptable and will be returned without review. All equipment, material, and manufacturer's literature shall be submitted for approval at one time and in a tabulated binder. Control drawings and the controls equipment submittal may be submitted at a later time, but as soon as practical after the contract has been awarded and after the general equipment submittal has been made. However, every attempt shall be made to include the complete controls submittal with the general equipment submittal at one time.
   2. The submittal shall include summary cover sheet(s) and manufacturer's literature under each tab of the submittal binder which together clearly indicate compliance or deviation from the specifications and drawings.
   3. Submission material and all shop drawings shall be marked with the appropriate identification relating the equipment to the drawings. Mark and reference each item on the submittal summary sheet and the manufacturer's literature to the appropriate paragraph number in the specifications. Manufacturer's standard catalogs will not be accepted.
   4. Failure to comply with the above for a complete and clear submittal may result in resubmittal.

B. Operating instructions and parts lists.
   1. Before requesting acceptance of work, furnish the number of printed and hardback bound sets required.
   2. Equipment and systems.
      a. Complete description of equipment and systems and basic operating features.
      b. Manufacturer's name, model number, service manual, spare parts list, and descriptive literature for all components
   3. Maintenance instructions.
   4. Listing of possible breakdown and repairs.
   5. Instruction for starting and operation.
   6. Detailed and simplified one line, color coded flow and wiring diagrams.
   7. Schedule of valve identification.

C. Field test report as required by Section 23 05 93 - BALANCING AND TESTING BY INDEPENDENT AGENCY.

1.6 JOB CONDITIONS

A. Examine related work and surfaces before starting work of any section.
   1. Report in writing, conditions which will prevent proper provision of this work.
   2. Installed work which interferes with architectural or any other work, or which deviates from drawings and specifications without prior approval, shall be altered by DIVISION 15 - MECHANICAL, without cost to Owner, to clear such interferences, or to comply with the drawings and specifications. Interferences or discrepancies which may be discovered or anticipated shall be reported promptly. ENGINEER/ARCHITECT shall have privilege of making minor changes without additional cost, provided that such changes are made before commencing work on items involved.

B. Existing Utilities: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling.

1.7 ACCURACY OF DATA AND DRAWINGS

A. Drawings are generally diagrammatic, and where not dimensioned or detailed, indicated approximate locations of work. Examine carefully existing buildings and structures, existing systems, and all other contract drawings, and install work to conform as nearly as possible to locations and arrangements indicated, with only such minor adjustments as necessary to coordinate mechanical work with other work, and to avoid interferences therewith. All piping and ductwork, offsets, rises, and fittings are not necessarily shown; however, provide these as required by the conditions involved.

B. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND STRUCTURAL DRAWINGS AND FROM ACTUAL MEASUREMENTS OF EACH EXISTING BUILDING AND EACH EXISTING STRUCTURE INVOLVED.

1.8 COORDINATION

A. Carefully examine the architectural, electrical, heating and air-conditioning, plumbing, fire protection, structural, and site plan drawings and specifications, and coordinate this work with that of others to avoid delay. The Contractor shall be responsible for ascertaining that the work he installs does not interfere with the work of other trades. If work is installed that does interfere, correct at no cost to the Owner. Preoccupation of space by any trade does not give the right of priority to the space.

B. In general, permanent openings or knockout panels are provided to permit only future service or replacement of system components, not the entire assembly. Each contractor shall coordinate his equipment delivery with construction progress so that installation may be made in an orderly manner.

C. The structural design is based on installed locations of the equipment only. Any necessary shoring or other protection necessary for moving heavy equipment to installed location is the responsibility of the Contractor. Take extra precautions in using any existing structure for hoisting or temporary support.

D. Wherever piping, conduits, ducts, or other items are to run in the same general direction, elevation, or location, coordinate for the proper allocation of the space position. If necessary, consult the ENGINEER/ARCHITECT, whose decision shall be final.

E. Wherever work is to be concealed or installed above ceilings, maintain adequate clearance to allow for access, repairs, and removal of all devices. The Contractor shall be responsible for protecting his installation from being blocked off by others. Should a conflict occur, bring the matter to the attention of the other trades for correction.

F. Coordinate setting of sleeves, anchor bolts, and inserts as required to accommodate equipment before concrete is set and masonry is placed.

1.9 ELECTRICAL CHARACTERISTICS, MOTORS, MOTOR STARTERS, CONTROLS, AND WIRING

A. Electrical Characteristics: Refer to electrical section for electrical characteristics of motors specified or scheduled under the Mechanical Section.

B. Motor Sizes: Motor horsepowers specified in Mechanical Section and/or indicated on mechanical drawings are approximate, and are not intended to limit motor sizes. Each motor shall be of proper size to operate continuously the actual equipment driven thereby, without overload on motor under all operating conditions, except as otherwise specified.

C. Motor starters and other electrical control devices: Generally, motor starters for equipment motors shall be furnished by DIVISION 26 - ELECTRICAL; however, this DIVISION shall furnish ONLY those motor starters which may be specified hereinafter in this DIVISION. Also, this DIVISION shall furnish all electrical control devices required for the Mechanical system, unless otherwise specified.

D. All motor starters shall comply with specifications for motor starters as specified in DIVISION 26.

E. In addition to the items specified in DIVISION 26, starters that operate in parallel with other starters shall be equipped with auxiliary contacts on the main disconnect for breaking one leg of the control power. In these cases, the secondaries of the starter transformers shall be properly phased.

F. Installation of electrical devices, EXCEPT those factory mounted on equipment: electrical control devices which require electrical connections ONLY, shall be installed by DIVISION 26 - ELECTRICAL; electrical control devices which required piping, linkage, remote bulb, or other mechanical connections IN ADDITION TO electrical connections, shall be installed by this Section, ready for electrical connections. Electric wiring: All electric wiring required to operate the mechanical systems, EXCEPT wiring which is factory installed on equipment, shall be done by DIVISION 26 - ELECTRICAL, in accordance with approved wiring diagrams which shall be furnished by this Section.

G. Install name plates with full data on all motors, starters, and disconnect switches.

1.10 TRANSPORTATION AND HANDLING

A. Pay all transportation and handling charges. Immediately report any damage to equipment received to the carrier so that job progress will not be delayed.

B. All items received by the Contractor shall be left in their original containers, or as shipped, where possible, until installed in final locations.

C. All items shall be protected from the elements. If stored outside, provide blocking to raise the base of each item well above ground and/or water levels.

D. Provide additional protection for items subject to damage, where necessary, so that when installed, the items will be in new condition.

E. Supply electrical items that might be damaged by condensation with heated air in an enclosed area until placed into service.

1.11 CUTTING AND PATCHING

A. Execute cutting (including excavating), fitting, and patching of work required to:
   1. Make several parts fit properly.
   2. Uncover work to provide for installation of ill-timed work.
   3. Remove defective work.
   4. Remove work not complying with the requirements of the contract documents.
   5. Remove samples of installed work as specified for testing.
   6. Where work is cut for any reason, restore cut and damaged areas with new materials meeting requirements of the contract documents.

B. In addition to the requirements above and upon written instructions of the ENGINEER/ARCHITECT, provide cutting, fitting, and patching to:
   1. Uncover work to provide observation of covered work.
   2. Remove samples of installed materials for testing.

C. Do not endanger work by cutting or altering work or any part of it.

D. Prior to cutting that affects structural safety of project, submit written notice to ENGINEER/ARCHITECT requesting consent to proceed with cutting, including:
   1. Identification of project.
   2. Description of affected work.
   3. Necessity for cutting.
   4. Affect on other work and on structural integrity of project.
   5. Description of proposed work. Designate scope of cutting and patching, trades to execute work, products proposed to be used, and extent of refinishing.
   6. Alternatives to cutting and patching.
   7. Designation of party responsible for cost of cutting and patching.

E. Prior to cutting and patching done on the instruction of the ENGINEER/ARCHITECT, submit cost estimate.

F. Should conditions of work or schedule indicate the need for change of materials or methods, submit written recommendations ENGINEER/ARCHITECT, including conditions indicating the need for change, recommendations for alternative materials or methods, submittals as required for substitution of materials, and cost estimate for changing materials or methods.

G. Submit written notice designating time work will be uncovered to provide for observation.

H. Costs caused by ill-timed or defective work and work not complying with requirements of the contract documents, including costs of additional services of ENGINEER/ARCHITECT, shall be borne by the party responsible for the ill-timed, defective, or non-complying work.

1.12 INSTRUCTION TO OWNER/OPERATING PERSONNEL

A. The Contractor shall furnish the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. The instruction will be for such length of time as is necessary to thoroughly familiarize the Owner's representative with the operation of the equipment. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given after the equipment or system has been accepted for regular operation. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

2.1 MATERIALS, SUBSTITUTIONS, AND PRODUCT OPTIONS

A. Substitution of other manufacturers and/or products may be made in accordance with Division 01. No substitutions will be made after bid without use of change order procedures noted in Division 01.

B. Deviations Required by Substitution:
1. Where the Contractor proposes to use an item of equipment other than that specified which requires any redesign of mechanical, structural, electrical, or architectural layout, all such redesign and all new drawings and detailing required therefor shall be prepared by the Contractor at no additional cost. All such redesign will require prior approval.
2. Where approved deviations in equipment or material require a different quantity and arrangement of piping, ductwork, wiring, conduit, or equipment from that specified or indicated on the drawings, the Contractor shall furnish and perform any such additional work at no additional cost. All additional work on equipment shall be prior approved.

2.2 NAME PLATE IDENTIFICATION

A. Four by two inch (minimum) size engraved and laminated plastic nameplate or black lamicoid sheet with white lettering.

2.3 PIPE IDENTIFICATION

A. Brady B-500 or equal self-sticking vinyl cloth markers and pipe marker arrows.

2.4 MOTORS

A. Every electric motor shall comply with NEMA Standard and be sized and designed to operate continuously at full load and full speed without causing noise, vibration, or temperature rise in excess of its rating.

B. Motors on belt drive equipment shall be furnished with apparatus for belt tension adjustment slide rails, idler pulley, or similar.

C. Motors shall be of sufficient size for the duty to be performed and shall not exceed the motor's full rated load when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. Insulation shall be Class F with Class B rise and moisture, fungus, and oil resistant treatment and shall be of a type designed and constructed to withstand the severe moisture conditions and the wide range of ambient temperature to which the motors will be subjected. Unless otherwise specified, all motors shall have open dripproof frames and shall be rated for continuous full load operation without exceeding the standard temperature rise permitted for the frame construction and class of insulation used.

PART 3 EXECUTION

3.1 FIELD TESTS

A. All piping shall be free of leaks, and test gauges shall show no loss of pressure for at least 30 minutes after source of test pressure has been cut off, or as noted. Pipes may be tested in sections as the work progresses. Repair and retest all sections failing to pass tests, as required to obtain approval of tests. No caulking, welding, or brazing will be permitted on threaded pipe or fittings to stop leaks. Replace with new material all cracked or otherwise

defective pipe and fittings of all types, as approved. Furnish suitable testing equipment, give all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal or insulate piping and do not conceal ductwork until all inspections have been made and all required tests have been approved by all applicable authorities. Submit results for review.

B. Provide required labor, material, equipment, and connections.

C. Test all piping, EXCEPT as otherwise specified below, as follows: hydrostatic test, at 150 percent of normal operating pressure of piping involved, or 100 psi, whichever is higher, AFTER removing all air from piping involved in test.
   1. Natural gas piping: 50 psi test using air or inert gas.
   2. Refrigerant piping:
      a. Isolate compressor, remove expansion valve and other controls or gauges subject to high pressure damage.
      b. Charge system (high and low side) with a refrigerant tracer charge of 10 psig (minimum).
      c. Using nitrogen, raise system test pressure up to 250 psig minimum (300 psig maximum).
      d. Use Halide leak detector test and bubble test to check system for leaks and make necessary repairs.
      e. After rechecking system as described above, let the system remain under test pressure for a 24 hour period (minimum).
      f. If no reduction in pressure is detected, aside from normal pressure changes due to ambient temperature changes, the system can be blown down.
      g. Reinstall expansion valve, controls, gauges, etc. and evacuate system to 1500 microns (minimum). Allow the system to stand under this vacuum for 12 hours (minimum). If no noticeable change has occurred the system shall then be charged with refrigerant.
      h. The system shall be charged with refrigerant to the full capacity required for operation or holding charge of 50 psig (minimum) may be utilized until full charging at a later date prior to initial startup.
   3. Test all equipment in accordance with sections specified hereinafter.

3.2 EXCAVATION AND BACKFILL

A. Excavation, Underground Pipework:
   1. Cut trenches to indicated and/or required lines, and to depths which will:
      a. Provide full length bearing of pipe barrels on firm ground.
      b. Provide 24 inch MINIMUM earth cover over all pipes outside of buildings and structures.
   2. Piping shall be laid on a six inch bed of sand and backfilled with 12 inches of sand in six inch layers.
   3. Seat pipe on sand fill as required to facilitate jointing, and to prevent pipe hubs, couplings and valves from bearing on sand before backfilling.
   4. Sheet and brace excavations as required to prevent cave-ins and protect personnel and adjacent structures.
   5. Where pipelines are below footings, horizontal distance between footings and pipelines shall be as required to provide not steeper than a 1:1 slope from footing bottoms to trench bottoms at all points.

B. Backfill, Trenches:
   1. After each pipeline has been laid, tested, and approved, thoroughly hand tamp backfill into bell holes, around pipe, and up to six inches above pipe top.
   2. Place remaining backfill in 8 inches maximum thickness loose layers, and with pneumatic or other suitable power tampers compact each layer to the backfill density specified in Section 31 20 00 - EARTHWORK.

3. Backfill materials shall be of the following types:
   a. Up to six inches above pipe tops: (12" and larger sand, ONLY).
   b. From six inches above pipe tops up to finished grade or subgrade, as required:
      (1) Any materials removed from the excavation and suitable for backfill, except do not use as backfill material any pieces of the following materials which are larger than six inches in their greatest dimensions: rock, stone, concrete, asphalt paving, or masonry.
      (2) Dispose of excavated materials which are not replaced as backfill, as approved.

C. Excavation and Backfill for Structures Related to Mechanical Work:
   1. This shall conform to applicable requirements in Section 31 20 00 - EARTHWORK.

D. Unsuitable Subsurface Conditions:
   1. Where excavation bottoms at required elevations are found to be unstable, or where rock, cinders, rubbish, or other deleterious materials are encountered, extend excavations down to firm earth, but at least six inches below deleterious materials.
   2. Bring excavation bottoms back up to required pipe laying subgrade by backfilling with suitable material, thoroughly compacted in place as specified in paragraph B above.
   3. "Suitable material" shall be as specified in paragraph B.3. above.
   4. Dispose of excavated unsuitable subgrade materials, as approved.

E. Warning Tape for Buried Pipeline: Install detectable warning tape directly over every pipeline by burying tape as close to the surface as possible but no less than six inches beneath finished grade.

3.3 ADJUSTING AND CLEANING

A. Flush or blow all welding slag, pipe joint compound, loose scale, and other debris from pipework before connecting equipment thereto.

B. After systems have been tested and before any field painting is commenced, clean up all work thoroughly. Remove all foreign matter which has accumulated in ducts, casings, enclosures, fixtures, and equipment. Clean and polish all valves, plates, and other surfaces that are not to be painted, so that they present a new and acceptable appearance.

C. Put systems in operation, test all fixtures and other equipment, remedy all leaks and defects, make all necessary adjustments, and remove all air from water circulating systems. Adjust all air and water flows to indicated and/or required quantities, and adjust all controls and other items as required to balance system and provide uniform air flows and uniform temperatures in air conditioned areas. Demonstrate that all controls and mechanical equipment function satisfactorily, as specified, as indicated, and as approved.

D. After systems have been tested and before putting any part of or the entire system in operation for Owner's beneficial use, insure that all necessary adjustments have been made.
   1. Bearings and other items requiring lubrication, except factory permanently lubricated type: lubricate each of these as recommended by its manufacturer; this includes lubricated type plug valves.
   2. Belts: adjust each of these to proper tension.
   3. Filters: replace each disposable ("throw-away") filter with a new clean filter (except blanket roll and high efficiency type). Clean each cleanable filter. NOTE: ALL FILTERS SHALL BE IN PLACE DURING TESTING AND ADJUSTING.
   4. Motor load tests: make an ammeter check of actual running current of each motor in mechanical system under operating conditions. Correct all motors which are found to be overloaded, as approved.

3.4 INSTALLATION

A. Equipment rooms and other areas in which equipment is to be installed have limiting dimensions. Install all mechanical work within these areas substantially as indicated, with ample unobstructed access space around each piece of equipment to facilitate proper installation, operation, and maintenance of equipment, and to allow ample space for plumbing, electrical, and other equipment indicated to be installed therein. Minor revisions in layout may be made subject to approval, but major changes in layout to accommodate proposed equipment which differs substantially from specified equipment in size and arrangement may not be considered or will be subjected to the provisions of paragraph 2.1 C. hereinbefore. Each bidder shall determine before bidding that equipment upon which he proposes to base his bid will conform to these requirements. Install each equipment item in accordance with its manufacturer's recommendations, and as indicated on the drawings, and/or specified. If the drawings and/or specifications conflict with the manufacturer's recommendations, report this to the ENGINEER/ARCHITECT for his decision before proceeding with the work involved.

B. Equipment NOT furnished by MECHANICAL section but requiring mechanical connections from other Sections and others furnishing this equipment: determine exact mechanical connection requirements therefor; locations and arrangements of connections indicated for this equipment are APPROXIMATE ONLY.

C. Generally, install pipework and ductwork as follows unless otherwise indicated.
   1. Finished areas: conceal pipework and ductwork within pipe chases, above suspended ceiling, and within other building construction, and other finished areas, unless otherwise indicated.
   2. Unfinished areas: install aboveground pipework and ductwork exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms, manufacturing areas, warehouse, or storage areas, and other unfinished areas.
   3. ALL areas: install pipework and ductwork parallel or at right angles with beams, walls, ceilings, and other building lines, in straight lines between required direction changes, with vertical runs plumb. Install exposed pipework and ductwork as close as practicable to walls, columns, ceilings, and overhead construction, and to provide maximum headroom and minimum interference with usable building space.

3.5 CUTTING AND PATCHING

A. Inspect existing conditions of work, including elements subject to movement or damage during cutting and patching and excavating and backfilling.

B. After uncovering work, inspect conditions affecting installation of new products.

C. Provide shoring, bracing, and support required to maintain structural integrity of the project.

D. Provide protection for other portions of the project.

E. Provide protection from the elements.

F. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.

G. Execute cutting and demolition by methods that prevent damage to other work and provide proper surfaces to receive installation of repairs and new work.

H. Execute excavating and backfilling by methods that prevent damage to other work and prevent settlement. Execute backfilling work in accordance with the requirements of the contract documents.

I. Refinish the entire surfaces where cutting and patching work occurs to provide an even, continuous surface to the nearest intersections. Where assemblies are damaged by cutting and patching, refinish entire assemblies.

3.6 PAINTING

A. All equipment shall be factory prime coated and painted, however, the following may be shop prime coated and made ready for painting:
   1. Tanks.
   2. Structural supports and frames.

B. Uncoated Hangers, Supports, Rods, and inserts shall be prime coated.

C. Exposed, uninsulated black steel piping, pipe supports, and pipe braces shall be prime coated.

D. Marred surfaces of prime coated or factory painted surfaces shall be painted and/or primed to match adjacent coat.

3.7 IDENTIFICATION

A. Identify valves, (including main pipe sectionalizing valves and branch valves) except those on or within hand reach of equipment controlled thereby with a minimum 1-1/2 inch diameter round brass or aluminum tag stamped with 1/4 inch (minimum) height letters designating material controlled by valve, and attached to valve body with 18 (minimum) gauge solid copper or galvanized steel wire. Submit a typed valve identification schedule with the operating instructions and parts list submittal described above under 1.5 SUBMITTALS.

B. Identify piping with Brady B-500 or equal self-sticking vinyl cloth pipe markers and pipe marker arrows, each sized as recommended by marker manufacturer for outside diameter of pipe (including pipe insulation) labeled therewith. Marker background colors shall conform to OSHA and ANSI pipe identification standards. Each pipe marker shall be lettered to indicate the material contained in the pipeline involved, and arrows shall indicate direction of material flow in the pipelines. Install appropriate pipe markers, each with a marker arrow adjacent thereto, on all above ground pipelines on 20 foot maximum centers, with at least one marker and arrow in each vertical run between floor and ceiling.

C. Equipment: Label each major mechanical equipment item (such as AHU, pump, fan, condensing unit, boiler, water heaters, etc.) with nameplate engraved with equipment designation and number, and securely attached to equipment.

END OF SECTION

SECTION 23 0593

BALANCING AND TESTING BY INDEPENDENT AGENCY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work Included in This Section: Adjusting and balancing all heating, ventilating and air conditioning systems in conformity with applicable codes and authorities having jurisdiction, for, but not limited to the following:
   1. Perform operational testing of central station equipment, balancing of distribution system, and adjustment of terminal devices for HVAC systems of Project.
   2. Provide instruments required for testing, adjusting and balancing operations.

1.2 RELATED SECTIONS

A. DIVISION 23 - MECHANICAL.

B. Section 23 01 00 - GENERAL PROVISIONS, MECHANICAL.

C. Section 23 31 00 - LOW VELOCITY DUCTWORK.

D. Section 23 09 00 - CONTROLS.

E. DIVISION 26 - ELECTRICAL.

1.3 REFERENCE STANDARDS

A. Published Specifications Standards, tests, or recommended methods of trade, industry, or governmental organizations apply to work in this section where cited by abbreviations noted below:
   1. AABC - Associated Air Balance Council.
   2. NEBB - National Environmental Balancing Bureau.
   3. SMACNA - Sheet metal and Air Conditioning Contractors National Association, Inc.

1.4 QUALITY ASSURANCE

A. Total system balance shall be performed by an agency certified be by the Associated Air Balance Council (AABC) or by the National Environmental Balancing Bureau (NEBB). All work done by this agency shall by qualified technicians under the direct supervision of a certified test and balance engineer.

B. If so requested by the Engineer, the Balancing and Testing Agency shall conduct the specified tests in the Engineer's presence.

1.5 SUBMITTALS

A. Submit the Following to Engineer:
   1. In list of materials submittal, furnish Engineer statement that:
      a. Air Balance Company is a member of Air Balance Council.
      b. It has satisfactorily balanced at least three systems of comparable type and size.
      c. Sample forms for use in compiling and recording test and balance data.
   2. Final submission shall include records and tabulations required hereinafter.

B. At least fifteen days prior to Trade Contractor's request for final inspection, submit required copies of final reports, on applicable reporting forms, for review.
   1. Schedule testing and balancing of parts of systems which is delayed due to seasonal, climatic, occupancy, or other conditions beyond control of Trade Contractor, as early as proper conditions will allow, after consultation with Engineer/Architect.
   2. Submit reports of delayed testing promptly after execution of those services.
   3. Form of final reports:
      a. Each individual final reporting form must bear the signature of person who recorded data and that of supervisor of the reporting organization.
      b. Identify instruments of all types which were used, and last date of calibration of each.

1.6 JOB CONDITIONS

A. Prior to start of testing, adjusting, and balancing, verify that required "Job Conditions" are met:
   1. Systems installation is complete and in full operation.
   2. Outside conditions are within a reasonable range relative to design conditions.
   3. Lights are turned "on" when lighting is included in the cooling load.
   4. Special equipment such as computers, laboratory equipment, and electronic equipment are in full operation.

PART 2 PRODUCTS

2.1 GENERAL

A. Acceptable Contractors. No substitutions.
   1. Environmental Test and Balance (901) 373-9946,
   2. Air Technical Services (901) 388-1272.
   3. Or equal.

B. Products and materials shall be as described in pertinent sections of DIVISION 23 - MECHANICAL.

PART 3 EXECUTION

3.1 AIR SYSTEM BALANCING

A. Operating test procedure shall be as follows:
   1. Records must be submitted in tabulated form to Engineer/Architect for review.

B. Check that filters are installed, free of bypass, and clean, type as specified.
   1. Make allowance for air filter resistance at time of tests.
   2. Main air supply to be at design air quantity at pressure drop across filter banks midway between pressure drop for clean and dirty filters.

C. Test and adjust blower rpm to design requirements.

D. Test and record motor full load amperes.

E. Make pitot tube traverse of main supply ducts and obtain design cfm at fans.

F. Test and record system static pressures, suction and discharges.

G. Test and adjust system for design recirculated air, cfm.

H. Test and adjust system for design cfm outside air.

I. Test and record entering DB heating and cooling temperature.

J. Test and record entering WB cooling air temperature.

K. Test and record leaving DB heating and cooling temperature.

L. Test and record leaving WB cooling temperature.

M. Adjust main supply, return, and exhaust air ducts to proper design cfm.

N. Adjust zones to proper design cfm, supply, return, and exhaust.

O. Test and adjust each diffuser, grille, and register to within 10 percent of design requirements.

P. Identify each grille, diffuser, and register as to location area, size, type, and manufacturer.

Q. Readings and tests of diffusers, grilles, and registers shall include:
   1. Required fpm velocity.
   2. Test resultant velocity.
   3. Required cfm.
   4. Test resultant cfm after adjustments.

R. In cooperation with control manufacturer, set adjustments of automatically operated dampers and terminal boxes to operate as indicated.

S. In cooperation with control manufacturer and mechanical contractor set adjustments of air terminal boxes as required to produce design performance.

T. Adjust diffusers, throw pattern, grilles, and registers to minimize drafts.

U. Test and record DB temperature in occupied zones.

V. Make changes in pulleys, belts, and dampers as required for correct balance as required at no additional cost to Owner.

W. Outside climatic conditions at the time of testing: Read and record DB and WB, temperatures, sunny, cloudy, or windy.

X. Read and record entering air: WB and DB temperatures of outside air.

3.2 CONTROL COORDINATION

A. Cooperate with control installer and equipment installer making adjustments to following items as required to accomplish indicated performance:
   1. Rooftop units.

B. The HVAC Section shall furnish copies of the manufacturer's literature and other data to the Balancing and Testing Agency for their use in balancing the air systems: fan performance data and curves; evaporator, flow curves; air handling unit coil flow curves; and other pertinent air distribution data.

END OF SECTION

SECTION 23 0705

MECHANICAL HVAC - INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work required under this section consists of materials, equipment, fabrication, installation and tests for insulation of the following items:
   1. Piping.
   2. Ductwork.
   3. Equipment.
   4. Fittings, valves and special covering.

1.2 RELATED SECTIONS

A. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of these specifications.

B. Division 07 - THERMAL AND MOISTURE PROTECTION.

C. DIVISION 23 - MECHANICAL.

D. Section 23 01 00 - GENERAL PROVISIONS MECHANICAL.

E. Section 23 82 00 - PACKAGED ROOF-TOP HEATING/COOLING UNITS.

F. Section 23 31 00 - LOW VELOCITY DUCTWORK.

G. Section 23 34 00 - DUCTWORK ACCESSORIES.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit manufacturer’s data sheets, specifications and installation instructions for applicable insulation materials specified in this section.

1.4 MATERIAL REQUIREMENTS

A. Fire Hazard Rating:
   1. Insulation for ductwork, pipe, stacks and breeching, and equipment located within the building shall have a fire hazard rating, certified by material manufacturer to be tested in accordance with U.L. 723 NFPA 255, and ASTM E84, not exceeding the following. "Insulation" includes insulating material, jacket, PVC fittings, vapor barrier, mastic, adhesive, tape, and cloth; collectively as a system or individually.
      a. Flame spread of 25 and smoke development of 50 for all ductwork and for any insulation locating in a ceiling plenum or a room used for a return plenum.
      b. Flame spread at 25 and smoke development of 200 for other pipe and equipment insulation within building.
      c. Insulation exposed to the weather shall be certified to be self-extinguishing in accordance with ASTM D1692.
   2. Chemicals used in order to treat materials shall not be water soluble or affected by water and humidity.

B. Basic Requirements:
1. All insulation materials shall be delivered and stored in manufacturer's container free from dirt, water, chemical and mechanical damage.
2. "R" - Values used herein are expressed in units of "Hour-degrees F - sq. ft./Btu per inch thickness" at an ambient temperature of 75° F, unless otherwise noted.
3. Provide factory premolded or shop or site mitered insulation for pipe fittings and valves, unless otherwise noted. Fitting insulation to be the same thickness and material as is specified for adjoining pipe.

PART 2 PRODUCTS

2.1 PIPING INSULATION

A. Flexible Tubular Elastomeric:
1. Provide fire-retardant, closed-cell, slip on flexible type. Product must be guaranteed by manufactured to have continuous operational temperature limit of not less than 220 degrees F and a minimum R value of 3.57. Provide insulation for the following services:

2.2 DUCTWORK INSULATION

A. Fiberglass Blanket
1. Provide minimum 1 pound per cubic foot density, flexible, factory reinforced foil-faced Kraft vapor barrier glass fiber blanket "system" type insulation, having a minimum "R" value installed of 3.92. Insulation to conform strictly to fire-resistive qualities hereinbefore specified. Provide insulation for following:
a. Unlined supply, return, and outside air ducts - 2" thick.

B. Acoustical Insulation
1. Acoustical duct lining shall be 1" thick, inorganic glass fiber material, with a minimum density of 1.5 pcf, and be suitably coated to prevent erosion. See drawings for location of lined duct runs. The material shall be Owens-Corning Fiberglass "Aeroflex" Ductliner, Johns-Manville "Micro-Lite" Ductliner, or Gustin-Bacon "Ultra liner."

2.3 FITTINGS, VALVES AND SPECIAL COVERINGS:

A. Provide coverings and finishes for specific items hereinafter specified.
1. One-Piece PVC Insulated Fitting Covers:
a. Provide factory pre-molded one-piece PVC insulated fitting covers, precut UNI-FIT insulation, and necessary installation materials for all pipe fittings.
2. For flexible tubular elastomeric pipe and fittings insulation when exposed-to-view inside building or in equipment rooms, finish with two coats of fire retardant self-extinguishing vinyl lacquer type highly flexible coating.
3. For flexible tubular elastomeric pipe and fitting insulation when exposed-to-the-weather outside of building, cover with two 1/16" applications for factory-mixed fibrated cutback vapor barrier asphalt, having one wrapping of woven glass fabric embedded in first coat. Finish to match surrounding surfaces using non-bleed color coat.
4. For kitchen range exhaust duct insulation, when concealed from normal view within building and in equipment rooms, finish with woven wire mesh wrap and one ½" thick coat of insulating cement, trowelled smooth.

PART 3 EXECUTION

3.1 GENERAL

A. Piping, Ductwork, and Equipment
1. The complete piping or duct systems shall have been tested and found free of all leaks prior to installation of any insulation on that system. All surfaces shall be clean and dry prior to covering with insulation.
2. All insulation shall be installed in strict accordance with manufacturer's recommendations.
3. No insulation shall be cut where a hanger is located. Insulation shall be installed such that specified thickness is preserved at every hanger, sleeve, or penetration of a wall, floor, or roof.
4. Stop all duct coverings, including jacket and insulation, at fire dampered penetrations of walls, floors above grade and roofs. "Fan-out" or extend jacketed insulation at least 2" beyond angle frames of fire dampers and secure to structure. Maintain vapor barrier. Install covering over damper access panel so as to be readily removable and identifiable.
5. Lap insulation jacket minimum of 1-1/2" at circumferential and longitudinal joints. Install longitudinal jacket laps concealed from normal view. Do not leave any visible mechanical fasteners, such as staples and/or bands on any service except within equipment rooms. Cover all staples with 3" wide vapor barrier tape or white vapor barrier coating Foster 30-35.
6. Cover all joints, rips, tears, punctures, disc heads, staples, or breaks in vapor barrier jacket with 4" wide woven glass fabric tape embedded in gray or white vapor barrier fire resistant coating.
7. Adhere flexible elastomeric sheet insulation to sheet metal ducts or equipment by compression fit method and full coverage of air drying contact adhesive. Seal butt joints with same adhesive. Apply same insulation and adhesive on standing metal seams for full height coverage as on duct or equipment surface.

3.2 PIPING

A. Apply flexible tubular elastomeric insulation to pipe and fittings with all joints tightly fitted and sealed with adhesive and tape. Longitudinally split insulation will not be acceptable unless specifically approved in writing by Architect.

B. Apply One-Piece PVC Insulated Fitting Covers As Follows:
1. General: Ends of UNI-FIT insulation to be tucked snugly into throat of fitting and edges adjacent to pipe covering tufted and tucked in fully insulating pipe fitting. One-piece PVC fitting cover to be secured with stainless steel tacks and by taping ends to adjacent pipe covering.

3.3 DUCTWORK

A. Apply jacketed blanket type glass fiber covering to ducts pulled snug but not so tight as to compress corners more than 1/4". Use insulation having 2" tab, or cut insulation long enough to allow for "peel-off" of insulation from jacket to effect a minimum overlap tab of insulation from jacket to effect a minimum overlap tab of insulation from jacket to effect a minimum overlap tab of 2". Staple lap with flare type staples on 2" centers. Cover standing seams, stiffeners, and braces with same insulation blanket, using 2" jacket lap and staple lap as hereinbefore outlined.
1. For duct 24" or wider, mechanically fasten insulation to duct bottom, using weld pins or nylon "stick-clip" base plates having, self-locking tin-coated metal or nylon discs, locating fasteners on not over 12" centers laterally and longitudinally.

END OF SECTION

SECTION 23 0900

CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.

B. All labor, material, equipment, software drivers, and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

1.2 DEFINITIONS

A. Definitions of the acronyms used in this specification are as follows:

DDC Direct Digital Controls
CC Configurable Controller
FMCS Facility Management and Control System
GUI Graphical User Interface
IDC Interoperable Digital Controller
INC Interoperable Niagara^{AX} Controller
LAN Local Area Network
NAC Network Area Controller
NICS Niagara Compatibility Statement
OOT Object Oriented Technology
PEC Programmable Equipment Controller
PICS Product Interoperability Compliance Statement
PMI Power Measurement Interface
POT Portable Operator's Terminal
TCS Temperature Control System
WAN Wide Area Network
WBI Web Browser Interface

1.3 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Sensors and Transmitters:
1. Flow meters
2. Press and temp sensor wells & sockets
3. Temp sensor wells and sockets

B. Control Valves:
1. Control valves

C. Control Dampers:
1. Automated Dampers

1.4 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. General:

1. Coordination Meeting: The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface including:

2. Direct Digital Controllers conforming to either the LonMark interoperability specification, or the BACnet, ANSI/ASHRAE Standard 135-2004 specification may be used.

   A. BACnet PICS, hardware, and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories.

   B. LonTalk All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.

3. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting.

B. Central HVAC Equipment – Roof Top Units:

1. Packaged RTU controls: Unit shall be furnished with a standard 24 volt terminal strip to accept control inputs from an external building automation system controller as specified. Factory mounted safeties and other controls shall not interfere with this controller.

C. Communications with Third Party Equipment:

1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet interface for integration into the Direct Digital Control System described in this section.

D. Agency and Code Approvals

1. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied. Verification that the applicable approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable:

   A. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
   B. ANSI/ASHRAE Standard 135-2004, BACnet.
   C. Uniform Building Code (UBC), including local amendments.
   D. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
   E. National Electrical Code (NEC).
   F. FCC Part 15, Subpart J, Class A
   G. EMC Directive 89/336/EEC (European CE Mark)

2. City, county, state, and federal regulations and codes in effect as of contract date.

   A. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

1.5 SYSTEM DESCRIPTION

A. The entire Temperature Control System (TCS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark/LonTalk and/or BACnet communication protocols to a Network Area Controller (NAC), provided under Division 27.

1.6 SCOPE OF WORK

A. The existing Talon Facility Management and Control System (FMCS) shall be expanded to include the new RTU's on the classroom expansion project. Contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control as herein specified. The system shall include all required computer software and hardware, controllers, sensors, transmission equipment, system workstations, local panels, conduit, wire, installation, engineering, database and setup, supervision, commissioning, acceptance test, training, warranty service and, at the owner's option, extended warranty service.

B. The system shall use LonTalk® as its native protocol and shall as a minimum include the capability of simultaneous communicating to native BACnet and MODBUS components. System components shall be certified by LONMARK® and display the LONMARK® logo where applicable. System components that do not have a published LONMARK® profile shall be compatible with the LONMARK® standards. For each LonWorks device that does not have LonMark certification, the device supplier must provide DRF and XIF files for the device.

C. The FMCS shall be capable of total integration of the facility infrastructure systems with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.

D. The FMCS shall communicate to third party systems such as chillers, boilers, air handling systems, energy metering systems, other energy management systems, access control systems, fire-life safety systems and other building management related devices with open, interoperable communication capabilities.

E. Systems that are not native LonTalk are not acceptable.

F. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project.

1.7 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.

B. Products furnished but not installed under this section:
   1. VFD's (use only on VAV jobs), Valves, flow switches, flow sensors, thermowells and pressure taps to be installed under Division 23.
   2. Automatic dampers to be installed under Division 23.

C. Coordination with electrical:
   1. Installation of all line voltage power wiring by Division 26.
   2. Each motor starter provided under Division 26, shall be furnished with individual control power transformer to supply 120-volt control power and auxiliary contacts (one N.O. and one N.C.) for use by this section.

D. Wiring of any electrical sub-metering devices furnished by FMCS Contractor.

1.8 QUALITY ASSURANCE

A. The system shall be furnished, engineered, and installed by the manufacturers' locally authorized representative. The controls contractor shall have factory-trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.

B. At the time of bid, all FMCS Configurable Controllers and Programmable Equipment Controllers shall be listed as follows:

1. American Society for testing and materials, ASTM
2. Institute of Electrical and Electronic Engineers, IEEE
3. National Electrical Manufacturers Association, NEMA
4. Underwriters Laboratory, UL 916
5. FCC Regulation, Part 15, Section 156
6. National Fire Protection Association, NFPA
7. Local building codes

C. The Manufacturer of the FMCS digital controllers shall provide documentation supporting compliance with ISO-9000:2000 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing). Product literature provided by the FMCS digital controller manufacturer shall contain the ISO-9000:2000 Certification Mark from the applicable registrar.

1.9 SUBMITTALS

A. Submit 10 complete sets of documentation in the following phased delivery schedule:
1. Valve and damper schedules
2. Equipment data cut sheets
3. System schematics, including:
   a. sequence of operations
   b. point names
   c. point addresses
   d. point to point wiring
   e. interface wiring diagrams
   f. panel layouts
   g. system riser diagrams
4. Visio® or AutoCAD compatible as-built drawings

B. Upon project completion, submit operation and maintenance manuals, consisting of the following:
1. Index sheet, listing contents in alphabetical order
2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams
3. Description of sequence of operations
4. As-Built interconnection wiring diagrams
5. User’s documentation containing product, system architectural and programming information.
6. Trunk cable schematic showing remote electronic panel locations, and all trunk data
7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
8. Conduit routing diagrams
9. Copy of the warranty
10. Operating and maintenance cautions and instructions
11. Recommended spare parts list

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

Controls Contractor	Manufacturer	Product Line
E|K AUTOMATION 2564 Hwy 51 South Hernando, MS 38632 Contact: Carl Christian (901-553-1623) cchristian@ekautomation.com	Siemens	Talon

A. Control systems shall comply with the terms of this specification.

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.
2. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

2.2 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with Control System Manufacturer.
2. Installer shall have successfully completed Control System Manufacturer's control system training and certification process. Upon request, Installer shall present record of completed training and certifications including course outlines.

2.3 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)
2. International Building Code (IBC)
    a. Section 719 Ducts and Air Transfer Openings
    b. Section 907 Fire Alarm and Detection Systems
    c. Section 909 Smoke Control Systems
3. International Mechanical Code (IMC)

2.4 SUBMITTALS

A. Product Submittal Requirements: Meet requirements on Shop Drawings, Product Data, and Samples. Provide six copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and 3 prints of each drawing on 11" x 17" paper. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Provide submittals within 12 weeks of contract award on the following:

1. Direct Digital Control System Hardware

a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.

b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:

i. Direct digital controllers (controller panels)
ii. Transducers and transmitters
iii. Sensors (include accuracy data)
iv. Actuators
v. Valves
vi. Relays and switches
vii. Control panels
viii. Power supplies
ix. Batteries
x. Operator interface equipment
xi. Wiring

c. Wiring diagrams and layouts for each control panel. Show termination numbers.
d. Floor plan schematic diagrams indicating field sensor and controller locations.
e. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Central System Hardware and Software

a. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.
b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

i. Central Processing Unit (CPU) or web server
ii. Monitors
iii. Keyboards
iv. Power supplies
v. Battery backups
vi. Interface equipment between CPU or server and control panels
vii. Operating System software
viii. Operator interface software
ix. Color graphic software
x. Third-party software

c. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
d. Network riser diagrams of wiring between central control unit and control panels.

3. Controlled Systems

a. Riser diagrams showing control network layout, communication protocol, and wire types.
b. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
c. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
d. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product datasheet number.
e. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified. Indicate alarmed and trended points.

4. Description of process, report formats, and checklists to be used in Control System Demonstration and Acceptance.

B. Schedules

1. Schedule of work provided within one month of contract award, indicating:
    a. Intended sequence of work items
    b. Start date of each work item
    c. Duration of each work item
    d. Planned delivery dates for ordered material and equipment and expected lead times
    e. Milestones indicating possible restraints on work by other trades or situations
2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents. Submit three copies of record (as-built) documents upon completion of installation for approval prior to completion. Submittal shall consist of:

1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and 6 prints of each drawing on 11" x 17" paper.

2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Control System Demonstration and Acceptance.

3. Operation and Maintenance (O&M) Manual. Printed, electronic, or online help documentation of the following:

    a. As-built versions of submittal product data.
    b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
    c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
    d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
    e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
    f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
    g. Graphic files, programs, and database on magnetic or optical media.
    h. List of recommended spare parts with part numbers and suppliers.
    i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
    j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
    k. Licenses, guarantees, and warranty documents for equipment and systems.
    l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based

training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

2.5 WARRANTY

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If Engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, Engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

2.6 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics
2. Record drawings
3. Database
4. Application programming code
5. Documentation

2.7 INTEROPERABLE DIGITAL CONTROLLER (IDC)

A. Controls shall be microprocessor based Interoperable LonMark™ or LonWorks Controllers (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable LonMark™ interoperability logo on each product delivered.

B. HVAC control shall be accomplished using LonMark™ based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device to the Division 27 contractor. Publicly available specifications for the Applications Programming Interface (API) must be provided to the Division 27 contractor for each LonWorks / LonMark controller defining the programming or setup of each device. The Division 23 contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.

C. The Division 23 contractor shall run the LonWorks network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC with the Division 27 contractor to ensure that maximum network wiring distances, as specified by the LonWorks wiring

guidelines, are not exceeded. A maximum of 126 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.

D. The Network Area Controller (NAC), supplied by the Division 27 contractor, will provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.

E. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

F. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

G. The Division 23 contractor supplying the IDC's shall provide documentation for each device, with the following information at a minimum:
   1. Network Variable Inputs (nvi's); name and type
   2. Network Variable Outputs (nvo's); name and type
   3. Network configuration parameters (nci, nco); name and type

H. It is the responsibility of the Division 23 contractor to ensure that the proper Network Variable Inputs and Outputs (nvi and nvo) are provided in each IDC, as required by the Point Charts located in the POINTS LIST section.

I. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.8 LONMARK DEVICES

The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers. The FMCS shall incorporate LonWorks™ technology using Free Topology Transceivers (FTT-10), and specific conformance to the LONMARK™ Interoperability Association's v3.0 (am verifying this) Physical Layer guidelines in all unitary, terminal and other device controllers. The system shall include:

A. Network Area Controllers (NAC's) for distributed system applications, databases and networking functions, shall conform to the LONMARK Application Layer V3.3 and higher Interoperability Guidelines.

B. Programmable Equipment Controllers (PEC's) for control of primary mechanical systems and distributed system applications. Controllers shall be fully programmable to create custom control solutions. They shall conform to the LONMARK Application Layer V3.0 and higher Interoperability Guidelines.

C. Configurable Controllers (CC's) for control of terminal equipment, air handling units, roof top units, and miscellaneous input/output points. They shall conform to the LONMARK Application Layer V3.3 Interoperability Guidelines.

D. Graphical User Interface (GUI), which includes the hardware and software necessary for a user to interface with the control system and devices.

E. The physical network shall use polarity insensitive twisted pair wiring and support star, home run, multi-drop, loop, or a mixture of these wiring topologies. The network shall communicate at a minimum 78Kbps.

F. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass control data shall not be acceptable.

G. To prevent any node from flooding the network with message traffic and ensure the receipt of critical data in a timely manor, the maximum acceptable response time from

any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces. All LonWorks components and controllers shall support maximum send time and minimum send time.

H. Communication and integration of 3rd party LONMARK® products shall be accomplished without gateways or interface devices. The 3rd party product supplier shall provide DRF and XIF files for each device.

I. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.9 INTEROPERABLE BACnet CONTROLLER (IBC)

A. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the ANSI/ASHRAE Standard 135-2004. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals. The system supplier must provide a PICS document showing the installed systems compliance level to the ANSI/ASHRAE Standard 135-2004, to the Division 27 contractor.

B. The IBCs shall communicate with the NAC via an Ethernet connection at a baud rate of not less than 10 Mbps or via the RS485 connection at a baud rate of not less than 38 kbps.

C. The IBC Sensor shall connect directly to the IBC and shall not utilize any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC Sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC Sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.

D. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IBC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

E. The Division 23 contractor supplying the IBC's shall provide documentation for each device, with the following information at a minimum:
   1. BACnet Device; MAC address, name, type and instance number
   2. BACnet Objects; name, type and instance number

F. It is the responsibility of the Division 23 contractor to ensure that the proper BACnet objects are provided in each IBC, as required by the Point Charts located in the POINTS LIST section.

2.10 INTEROPERABLE NIAGARA^{AX} CONTROLLERS (INC)

A. Controls shall be microprocessor based Interoperable Niagara Controllers (INC) in accordance with the JSR-60 Baja Specification. INCs shall be provided for applications as shown on the drawings. The application control program shall be resident within the same enclosure as the discrete input/output circuitry, which translates the sensor and actuator signals. The INC may communicate serially using standard protocols with control devices of the equipment that it is controlling The system supplier must provide a NICS document showing the installed system's compliance level to the Software Licensing Agreement in Division 27 of this specification.

B. The INCs shall communicate with the NAC via an Ethernet connection at a baud rate of not less than 10 Mbps.

C. All INCs shall be fully application programmable. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the INC shall be stored in

non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

D. The Division 23 contractor supplying the INCs shall provide documentation for each device, with the following information at a minimum:

1. IP and MAC address, name, type and HostID
2. Niagara Objects; name, type and instance number

E. It is the responsibility of the Division 23 contractor to ensure that the proper Niagara objects are provided in each INC, as required by the Point Charts located in the POINTS LIST section.

2.11 NETWORK AREA CONTROLLER (NAC)

A. The Division 27 contractor shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided under Divisions 23 and 26. It is the responsibility of the Division 27 contractor to coordinate with the Division 23 and 26 contractors to determine the quantity and type of devices.

B. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of controller data through NiagaraAX drivers installed in the NAC.
7. Network Management functions for all controllers

C. The Network Area Controller must provide the following hardware features as a minimum:

1. One Ethernet Port – 10/100 Mbps
2. One RS-232 port
3. One LonWorks Interface Port – 78KB FTT-10A
4. One RS-485 ports
5. Battery Backup
6. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
7. The NAC must be capable of operation over a temperature range of 32 to 122°F
8. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
9. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

D. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

E. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

F. Event Alarm Notification and actions

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.

3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
   a. To alarm
   b. Return to normal
   c. To fault
4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
5. Provide timed (schedule) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

G. Control equipment and network failures shall be treated as alarms and annunciated.

H. Alarms shall be annunciated in any of the following manners as defined by the user:
1. Screen message text
2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
   a. Day of week
   b. Time of day
   c. Recipient
3. Pagers via paging services that initiate a page on receipt of email message
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer

I. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, access way, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

J. Alarm actions may be initiated by user defined programmable objects created for that purpose.

K. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

L. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

M. Provide a “query” feature to allow review of specific alarms by user defined parameters.

N. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

O. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.12 DATA COLLECTION AND STORAGE

A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
1. Designating the log as interval or deviation.

2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.

D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

E. All log data shall be available to the user in the following data formats:
1. HTML
2. XML
3. Plain Text
4. Comma or tab separated values

F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
1. Archive on time of day
2. Archive on user-defined number of data stores in the log (buffer size)
3. Archive when log has reached it's user-defined capacity of data stores
4. Provide ability to clear logs once archived

2.13 AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
1. Time and date
2. User ID
3. Change or activity: i.e., Change setpoint, add, or delete objects, commands, etc.

2.14 DATABASE BACKUP AND STORAGE

A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.15 PROGRAMMABLE EQUIPMENT CONTROLLERS (PEC)

A. Programmable Equipment Controllers (PEC's) shall be stand-alone, multi-tasking, real-time digital control processors.

B. The PEC's shall communicate via native LonTalk protocol and be compatible with the LONMARK® standards. Provide a minimum of 4MB Random Access Memory in each PEC.

C. The PEC must communicate peer-to-peer with the all of the network configurable and programmable controllers sharing alarming and scheduling information.

D. Programming of the PEC shall be accomplished by using graphical software that incorporates drag and drop capabilities. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared / bound with any controller or interface device on the network.

E. PEC's shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
   1. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's or Configurable Controllers (CC) on the LonTalk network.
   2. Processes shall be able to generate operator messages and advisories to operator I/O devices.

F. Each PEC shall support firmware upgrades without the need to replace hardware.

G. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components.

H. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
   1. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
   2. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, downtime, and re-load time.

I. Provide a separate PEC for each AHU or other HVAC system. All system points shall reside on a single controller.

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2.16 CONFIGURABLE CONTROLLERS (CC)

A. Each Configurable Controller (CC) shall operate as a stand-alone LonMark® compliant controller capable of performing its specified control responsibilities independent of other controllers in the network. Each CC shall be a minimum 16-BIT microprocessor based, multi-tasking, multi-user, real time digital control processor.

B. Each CC's application must comply with one of the following LONMARK® interoperability profile guidelines:
   1. Unit Ventilators - Profile 8505
   2. Talon Display - Profile 8500
   3. Programmable Thermostat Controllers - Profile 8500

C. Flash memory reloads or updating of an existing control algorithm shall be completed over the network.

D. Network access shall be accomplished at the CC room sensor or the CC. Where applicable, system wide node access shall be available from connecting to the room sensor jack. Systems that do not have a system access jack from the room sensor shall provide a dedicated network jack next to each room sensor.

E. Controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog and digital outputs shall be industry standard signals such as 0-10V and 3-point floating control allowing for interface to a variety of industry standard modulating actuators. The CC inputs shall consist of industry standards types such as 10K thermistor, 0-10V, 4-20mA and DI. Inputs shall be electrically isolated from outputs, communications and power. All inputs shall be provided with an auto-calibrate function to eliminate sensing errors.

F. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the network is not acceptable.

G. The CC must be mounted remotely from the room sensor. CC's, that are wall mounted with integral room sensors, are not acceptable.

H. The control program shall reside in the CC. The application program configuration information shall be stored in non-volatile memory with no battery back up.

I. After a power failure the CC must run the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

J. The CC design must support pre-wiring of the hardware components where the electronics are not exposed to the harsh construction phase environment.

K. The CC design must also support an integrated controller/actuator design for the VAV/CV zone level installations where the controller processing and I/O are contained within a single 3-point floating actuator housing.

L. Programmable Communicating Thermostat (PCT). Must be available with and without scheduling capability with a menu-driven, back-lit LCD display. The PCT must have the ability to perform configuration directly at the thermostat, through the usage of a concealed button or via the network. Must contain two digital inputs, and, depending on the model, up to three remote sensor inputs must be available. All models with scheduler must contain a SPST auxiliary switch, which can be used to control lighting or disable the economizer function. The PCT must be capable of communicating via either native LonTalk or native BACnet.

1. WEB BROWSER CLIENTS

   a. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Mozilla FireFox™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

   b. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.

   c. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

   d. The Web browser client shall support at a minimum, the following functions:

      i. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be

displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

ii. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

iii. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

iv. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

v. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.

vi. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

A. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

B. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

C. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

D. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

E. View logs and charts

F. View and acknowledge alarms

G. Setup and execute SQL queries on log and archive information

vii. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

e. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2. "Talon AX" Global Supervisor - SERVER FUNCTIONS AND HARDWARE

a. *A central server, located at Desoto County Board of Education, shall be provided by the DDC contractor. The server shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.*

b. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1, or dial-up connection.

c. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

d. The server shall provide the following functions, at a minimum:

i. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.

ii. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.

iii. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).

iv. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.

v. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.

vi. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

vii. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.

viii. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

ix. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
   A. Routing of alarms to display, printer, email and pagers
   B. View and acknowledge alarms
   C. Query alarm logs based on user-defined parameters

x. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
   A. Viewing and printing log data
   B. Exporting log data to other software applications
   C. Query log data based on user-defined parameters

e. Server Hardware Requirements: The server hardware platform shall have the following requirements:

i. The computer shall be an Intel Pentium M based computer (minimum processing speed of 2.4 GHz with 1 GB RAM and a 100-gigabyte minimum hard drive). It shall include a DVD-ROM/CD-RW Combination Drive, 2-parallel ports, 2-asynchronous serial ports and 2-USB ports. A minimum 17" flat panel color monitor, 1280 x 1024 optimal preset resolution, 25 ms response time shall also be included.

ii. The server operating system shall be Microsoft Windows XP Professional. Include Microsoft Internet Explorer 6.0 or later.

iii. Connection to the FMCS network shall be via an Ethernet network interface card, 100 Mbps.

iv. A system printer shall be provided. Printer shall be laser type with a minimum 600 x 600-dpi resolution and rated for 60-PPM print speed minimum.

v. For dedicated alarm printing, provide a dot matrix printer, either 80 or 132 column width. The printer shall have a parallel port interface.

3. SYSTEM PROGRAMMING

a. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

b. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future

use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide “real-time” data update. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

c. Programming Methods

i. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page, and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

ii. Configuration of each object will be done through the object’s property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

iii. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

iv. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.

v. The system shall support object duplication within a customer’s database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

4. LonWorks NETWORK MANAGEMENT

a. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as “binding”. Systems requiring the use of third party LonWorks network management tools shall not be accepted.

b. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance, and network variable binding.

c. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

d. These tools shall provide the ability to “learn” an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

e. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

5. OBJECT LIBRARIES

a. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
b. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
c. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
d. All control objects shall conform to the control objects specified in the BACnet specification.
e. The library shall include applications or objects for the following functions, at a minimum:
    i. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
    ii. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
    iii. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
    iv. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
    v. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
    vi. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed, or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object

shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

f. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.
   i. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
   ii. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
   iii. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an “on” condition. The user must be able to specify either input condition as the “on” condition.
   iv. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
   v. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
   vi. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
   vii. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
   viii. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
   ix. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

x. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an “On” state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.

xi. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the “contained” application that are represented on the graphical shell of this container.

g. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included in the programming software:

i. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.

ii. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file, and documentation for the device to facilitate device integration.

iii. For BACnet devices, provide the following objects at a minimum:

A. Analog In
B. Analog Out
C. Analog Value
D. Binary
E. Binary In
F. Binary Out
G. Binary Value
H. Multi-State In
I. Multi-State Out
J. Multi-State Value
K. Schedule Export
L. Calendar Export
M. Trend Export
N. Device

iv. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

v. For BACnet devices, provide the following support at a minimum

A. Segmentation
B. Segmented Request
C. Segmented Response
D. Application Services
E. Read Property
F. Read Property Multiple
G. Write Property
H. Write Property Multiple
I. Confirmed Event Notification
J. Unconfirmed Event Notification
K. Acknowledge Alarm
L. Get Alarm Summary
M. Who-has

N. I-have
O. Who-is
P. I-am
Q. Subscribe COV
R. Confirmed COV notification
S. Unconfirmed COV notification
T. Media Types
U. Ethernet
V. BACnet IP Annex J
W. MSTP
X. BACnet Broadcast Management Device (BBMD) function
Y. Routing

6. Open Building Information Exchange (oBIX) DEVICE INTEGRATION
   a. The Network Area Controller shall support the integration of device data via Open Building Information Exchange (oBIX), over the Ethernet Network. The Network Area Controller shall act as a oBIX client or server to another software application that supports oBIX.
   b. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the FMCS. Objects provided shall include at a minimum:
      i. oBIX Generic AI Object
      ii. oBIX Generic AO Object
      iii. oBIX Generic BO Object
      iv. oBIX Generic BI Object
7. MODBUS SYSTEM INTEGRATION
   a. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.
   b. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:
      i. Read/Write Modbus AI Registers
      ii. Read/Write Modbus AO Registers
      iii. Read/Write Modbus BI Registers
      iv. Read/Write Modbus BO Registers
   c. All scheduling, alarming, logging, and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.
   d. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning
8. OPC SYSTEM INTEGRATION
   a. The Network Area Controller shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP as required by the device. The OPC client shall support third party OPC servers compatible with the Data Access 1.0 and 2.0 specifications.
   b. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the OPC system data into the BAS. Objects provided shall include at a minimum:
      i. Read/Write OPC AI Object
      ii. Read/Write OPC AO Object
      iii. Read/Write OPC BI Object
      iv. Read/Write OPC BO Object
      v. Read/Write OPC Date/Time Input Object
      vi. Read/Write OPC Date/Time Output Object
      vii. Read/Write OPC String Input Object

viii. Read/Write OPC String Output Object

c. All scheduling, alarming, logging, and global supervisory control functions, of the OPC system devices, shall be performed by the Network Area Controller.

d. The FMCS supplier shall provide a OPC client communications driver. The equipment system vendor that provided the equipment utilizing OPC shall provide documentation of the system's OPC server interface and shall provide factory support at no charge during system commissioning.

9. GRAPHICAL USER INTERFACE COMPUTER HARDWARE

(DESKTOP Owner Furnished)

A. The browser workstation shall be an Intel Pentium based computer (minimum processing speed of 2.4 Ghz with 1.0 GB RAM and a 100-gigabyte minimum hard drive). It shall include a DVD-ROM/CD-RW Combination Drive, 1-parallel ports, 1-asynchronous serial ports, and 2-USB ports. A minimum 17"flat panel color monitor, 1280 x 1024 optimal preset resolutions, 25 ms response time, shall also be included.

B. *Connection to the FMCS network shall be via an Ethernet network interface card, 10 Mbps*.

10. Controller Software

A. Building, and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. System Security. See Paragraph 2.2.G.3, Paragraph 2.9.H (Security), and 2.10.D.1 (Web Client).

C. Scheduling. See Paragraph 2.9.4. System shall provide the following schedule options as a minimum:

1. Weekly. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 10 on/off events per day (5 start-stop pairs or 10 events).
2. Exception. Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.
3. Holiday. Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

D. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

E. Binary and Analog Alarms. See Paragraph 2.11.9.

F. Alarm Reporting. See Paragraph 2.9.J (Alarm Console).

G. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

H. Demand Limiting.

1. System shall monitor building power consumption from building power meter, pulse generator signals, from building feeder line watt transducer, or current transformer.
2. When power consumption exceeds adjustable levels, system shall automatically adjust set points, de-energize low-priority equipment, and take other programmatic actions to reduce demand. When demand drops below adjustable levels, system shall restore loads as specified.

I. Maintenance Management. System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified.

J. Sequencing. Application software shall sequence chillers, boilers, and pumps as specified.

K. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, set point, 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.

L. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

M. Energy Calculations.

1. System shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

N. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

O. On and Off Control with Differential. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and set point.

P. Runtime Totalization. System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified.

11. Controllers

A. General. Network Application Controller (NAC), Interoperable Digital Controller (IDC), Configurable Controller (CC), Programmable Equipment Controllers (PEC), and Programmable Communicating Thermostats (PCT) as required to achieve specified performance. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard LonTalk specification, or BACnet Device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L unless otherwise specified. Hardwired actuators and sensors may be used in lieu of LonMark CC, or BACnet Smart Actuators and Smart Sensors.

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. NAC, IBC, PEC, CC, and PCT 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 NAC and IBC shall share data as required with each networked NAC and IBC.
4. Stand-Alone Operation. Each piece of equipment specified 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.

12. Input and Output Interface

A. General. Hard-wire input and output points to NACs, IBCs, PECs, CCs, or PCTs.

B. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA, and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

C. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

D. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

E. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Analog outputs shall not drift more than 0.4% of range annually.

F. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

G. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

13. Power Supplies and Line Filtering

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.

b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:

a. Dielectric strength of 1000 V minimum

b. Response time of 10 nanoseconds or less

c. Transverse mode noise attenuation of 65 dB or greater

d. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

PART 3 EXECUTION

3.1 PROJECT MANAGEMENT

Provide a project manager who shall, as a part of his duties, be responsible for the following activities:

A. Coordination between this Contractor and all other trades, owner, local authorities and the design team.

B. Scheduling of manpower, material delivery, equipment installation and checkout.

C. Maintenance of construction records such as project scheduling and manpower planning and

AutoCAD or Visio for project co-ordination and as-built drawings.

D. Coordination/Single point of contact

3.2 INSTALLATION METHODS

A Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and equipment details. Install electrical components and use electrical products complying with requirements of applicable Division-16 sections of these specifications.

B. The term "control wiring" is defined to include providing of wire, conduit, and miscellaneous materials as required for mounting and connecting electric or electronic control devices.

C. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in mechanical rooms and areas where other conduit and piping are exposed shall run in UL plenum rated cable as approved by local codes unless expressly restricted by requirements in Division 16 specification.

D. All Controllers, Relays, Transducers, etc., required for stand-alone control shall be housed in a NEMA 1 enclosure with a lockable door.

3.3 SYSTEM ACCEPTANCE

A. General: The system installation shall be complete and tested for proper operation prior to acceptance testing for the Owner's authorized representative. A letter shall be submitted to the Architect requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at this time.

B. Field Equipment Test Procedures: DDC control panels shall be demonstrated via a functional end-to-end test. Such that:
   1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.
   2. All analog input channels shall be verified for proper operation.
   3. All digital input channels shall be verified by changing the state of the field device and observing the appropriate change of displayed value.
   4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.
   5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.
   6. Selected time and setpoint schedules shall be verified by changing the schedule and observing the correct response on the controlled outputs.

C. As-Built Documentation: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply "6" complete 11x17 as-built drawing sets, together with AutoCAD or Visio diskettes to the owner.

D. Operation and Maintenance Manuals: Submit three copies of operation and maintenance manuals. Include the following
   1. Manufacturer's catalog data and specifications on sensors, transmitters, controllers, control valves, damper actuators, gauges, indicators, terminals, and any miscellaneous components used in the system.
   2. An operator's manual that will include detailed instructions for all operations of the system.
   3. An operator's reference table listing the addresses of all connected input points and

output points. Settings shall be shown where applicable.
4. A programmer's manual that will include all information necessary to perform programming functions.
5. Flow charts of the control software programs utilized in the DDC system.
6. Flow charts of the custom software programs utilized in the DDC system as approved.
7. Complete program listing file and parameter listing file for all programs.
8. A copy of the warranty.
9. Operating and maintenance cautions and instructions.

3.4 TRAINING

A. Contractor shall provide to the engineer a customized training class outline that is based upon the sites system layout prior to any scheduled training. On-site pre-canned training classes are not acceptable.

B. Factory trained control engineers and technicians shall provide training sessions for the Owner’s personnel.

C. The control contractor shall conduct two (2) eight-hour training courses for the designated owner’s personnel in the maintenance and operation of the control system. One class shall be given upon system acceptance and the other approximately six months into the warranty.

D. The course shall include instruction on specific systems and instructions for operating the installed system to include as a minimum:
1. HVAC system overview.
2. Operation of Control System
3. Function of each Component
4. System Operating Procedures
5. Programming Procedures
6. Maintenance Procedures

3.5 WARRANTY

A. The control system shall be warranted to be free from defects in both material and workmanship for a period of one (1) year of normal use and service. This warranty shall become effective the date the owner accepts or receives beneficial use of the system.

END OF SECTION

SECTION 23 3001

AIR DISTRIBUTION EQUIPMENT (FANS)

PART 1 GENERAL

1.1 HVAC CONTRACTOR PROVIDES

A. Power roof exhausters.

1.2 RELATED WORK

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

B. Section 23 00 00 - HVAC, BASIC MATERIALS AND METHODS.

C. Section 23 82 00 - PACKAGED ROOF-TOP HEATING/COOLING UNITS.

D. Section 23 31 00 - LOW VELOCITY DUCTWORK.

E. DIVISION 26 - ELECTRICAL.

1.3 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association, Inc., SMACNA:
   1. SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

1.4 SUBMITTALS

A. Submit in accordance with DIVISION 01.

B. Shop Drawings:
   1. Submit assembly-type shop drawings showing unit dimensions, clearances, construction details and field connection details.

C. Product Data:
   1. Submit manufacturer's data for air distribution equipment, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gauges and finishes of materials, dimensions, weights, accessories furnished and installation instructions.

D. Maintenance Data:
   1. Submit maintenance instructions, including lubrication instructions, motor and drive replacement and spare parts list; include this data in maintenance manuals.

1.5 REGULATORY REQUIREMENTS

A. Air Movement and Control Association, AMCA:
   1. Comply with AMCA standards for testing, performance and sound ratings of fans.
   2. AMCA Certified Rating Seal on all fans.
   3. AMCA 210: Laboratory Methods of Testing Fans for Rating.

B. National Electrical Code, NEC:
   1. Comply with NEC/NFPA No. 70 for installation of fan motors and associated electric wiring and equipment.

C. Underwriters Laboratories/National Electrical Manufacturers' Association, UL/NEMA:
   1. Electrical motors and products listed and labeled by UL and in compliance with NEMA Standards.

PART 2 PRODUCTS

2.1 PERFORMANCE

A. Fan performance based on actual conditions.

B. Fans tested and rated in accordance with AMCA 210.

C. See Fan Schedule on Drawings.

2.2 POWER ROOF EXHAUSTERS (PRE)

A. Hooded Centrifugal Type
   1. Acceptable Manufacturers:
      a. Acme Eng. & Mfg. Corp. : P
      b. Aerovent Fan Co. Inc. : FACX
      c. Greenheck Fan & Ventilator : G
      d. Jenn Air Corp. : BCRE
      e. Loren Cook Company : ACE
      f. Penn Ventilator : DOMEX
   2. Construction:
      a. Housing and Base: Aluminum, weatherproof with integral bird screen.
      b. Wheel: Backwardly-inclined air foil or flat bladed wheel of aluminum welded construction.
      c. Drive: Belt-drive units, adjustable sheaves; motor and fan drive shaft separated from base with rubber in shear vibration isolators.
      d. Dampers: Self-operating, multi-bladed, aluminum, backdraft dampers with attachable flange for mounting on roof curb.
      e. Accessibility: Access from roof to motor, drive and fan wheel with lift hinge or removable hood.
      f. All Surfaces in Air Stream: Non-ferrous.
      g. Provide independent raceway for electrical feed between base and motor housing.
      h. Internal local disconnect.
   3. Roof Curb: Insulated, prefabricated aluminum type furnished by fan manufacturer; designed to fit roof construction.
      a. Provide sound attenuating when indicated on Drawings

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate with other work, including ductwork and electrical connection work.

B. Coordinate roof-mounted fan installation with roofing, decking, flashing and electrical connection work.

3.2 INSTALLATION

A. Supply and install sheaves for final air balancing with sheave diameters and widths in accordance with NEMA MG1-14.43a.

B. Set roof-mounted fans on curbs.
   1. Bolt fan securely to curb.

C. Electrical Connections:
   1. Ensure that fan units are wired properly, with rotation in direction indicated; designed for proper fan performance.
   2. Provide positive electrical equipment and motor grounding.
   3. Provide variable speed controller for direct drive fans.

D. Pipe drainage from indicated fans to floor drain.

3.3 FIELD QUALITY CONTROL

A. After completion of installation and after motor has been energized, test each fan to demonstrate proper operation of unit at performance specifications, including proper rotation of impeller.

B. When possible, field-correct malfunctioning units; then retest to demonstrate compliance.
   1. Replace units which cannot be satisfactorily corrected.

C. Remove all hold-down and shipping tags.

3.4 ADJUSTING AND CLEANING

A. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings are lubricated and fan has been run under observation.

3.5 FAN SCHEDULE

A. See Schedule on Drawings.

END OF SECTION

SECTION 23 3100

LOW VELOCITY DUCTWORK

PART 1 GENERAL

1.1 HVAC CONTRACTOR PROVIDES

A. Ductwork

B. Fasteners

C. Sealants

D. Duct Cleaning

E. Plenums

1.2 RELATED WORK

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

B. SECTION 23 01 00 - BASIC MECHANICAL REQUIREMENTS

C. SECTION 23 07 05 - MECHANICAL INSULATION

D. SECTION 23 82 00 - PACKAGED ROOFTOP HEATING/COOLING UNITS

E. SECTION 23 34 00 - DUCTWORK ACCESSORIES

F. SECTION 23 37 00 - AIR OUTLETS AND INLETS

1.3 REFERENCES

A. American Conference of Governmental Industrial Hygienists: Industrial Ventilation.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, ASHRAE:
   1. ASHRAE Handbook and Product Directory.

C. Sheet Metal and Air Conditioning Contractors National Association, Inc., SMACNA:
   1. SMACNA's HVAC Duct Construction Standards - metal and Flexible.

1.4 DEFINITIONS

A. Duct Sizes: Inside clear dimensions.
   1. For acoustically-lined duct, maintain size inside lining.

B. Low Pressure: Static pressure in duct less than 2 inch w.g. and velocities less than 2,000 FPM.

1.5 SUBMITTALS

A. Submit in accordance with Division 01.

B. Shop Drawings:
1. Submit 1/8 scale shop drawings and samples of duct fittings, including particulars such as gauge sizes, welds and configurations prior to start of work.

1.6 REGULATORY REQUIREMENTS

A. National Electrical Code, NEC (1991):
1. NEC 300-21: Wiring Methods: Spread of Fire or Products of Combustion.

B. National Fire Protection Association, NFPA:
1. NFPA 90A: Air Conditioning and Ventilating Systems.
2. NFPA 96: Standard for Installation of Equipment for Removal of Smoke and Grease-Laden Vapors from Commercial Cooling Equipment.

C. Underwriters Laboratories, UL:
1. UL 181: Factory-Made Duct Materials and Air Duct Connections.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect shop-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling.
1. Stored materials subject to rejection due to damage.
2. Ductwork exposed and painted in finished spaces protected and handled as decorative ductwork.

PART 2 PRODUCTS

2.1 MATERIALS

A. Exposed Ductwork Materials:
1. Where ductwork is to be exposed to view in occupied spaces, provide materials free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains, discolorations, and other imperfections, including those which would impair painting.

B. Ductwork Metal:
1. Galvanized Steel: ASTM A653, lock-forming quality, G90 zinc coating, paint grip type where painted in exposed locations.
2. Black Steel: ASTM A569, hot-rolled sheet.
3. Aluminum: ASTM B209, alloy 3003, Temper H14.
4. Stainless Steel: ASTM A167, AISI Type 302/304, No. 4 directional polish where exposed to view.

C. Flexible Ductwork, Non-Insulated: Suitable for -20°F to 220°F temperature range, and minimum 6 inches w.c. working pressure.
1. Acceptable Manufacturers:
a. Flexmaster: Type NI 65
b. Genflex: HDL
c. Thermaflex: SLP
2. Glass fiber, PVC coating, factory-clinched in cold-rolled, galvanized steel spiral, or with spiral wire permanently bonded to fabric, complying with NFPA 90.

D. Miscellaneous Ductwork Materials:
1. Fasteners: Rivets and bolts used throughout; sheet metal screws acceptable on low pressure ducts.
2. Sealant: Water-resistant, fire-resistant, compatible with mating materials.

E. Fire and Smoke Penetration Sealant: UL rated, flexible sealant pre-fabricated metal device, NEC 300-21.

2.2 FABRICATION

A. Accessories:
1. Fabricate ductwork with accessories such as air turns, extractors and volume dampers; installed during fabrication to greatest extent possible.
2. Fabricate ductwork with duct liner in each section of duct where duct liner is indicated or scheduled; duct liner laminated to internal duct surface with adhesive and mechanical fasteners in accordance with manufacturer's recommendations.

B. Variation:
1. Size round ducts installed in place of rectangular ducts from ASHRAE table of equivalent rectangular and round ducts. Maintain clearances to obstructions.
2. No variation of duct configuration or sizes permitted except by written permission.

C. Directional Change:
1. Construct tees, bends and elbows with radius minimum 1-1/2 times width of duct on center line.
2. Where not possible and where rectangular elbows used, provide air foil type or other type turning vanes.

D. Size Change:
1. Increase and decrease duct sizes gradually, not exceeding 15^{o} divergence and 30^{o} convergence, unless otherwise indicated on Drawings.
2. Maximum Divergence Upstream of Equipment: 20^{o} and 30^{o} convergence downstream.
3. Collars in caps not acceptable.

E. Seams and Joints: In accordance with SMACNA standards.
1. Contractor's Option: Transverse joints.
a. Acceptable Manufacturer:
(1) Ductmate Industries, Inc.: Ductmate System
2. Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced an stiffened so not to breathe, rattle, vibrate or sag.
3. Fabricate seams and joints liquid-tight with continuous exterior welds or gasketed, bolted flanged connections in kitchen or other high-grease content ductwork.
4. Fabricate duct seams and joints liquid-tight with sealant or solder in following locations:
a. Dishwasher or other high-moisture content.
b. Shower rooms.
c. Lower 6 inches of horizontal outdoor air ducts.

F. Maximum Air Leakage:
1. Fabricate and seal ductwork to maintain following minimum air leakages, inward or outward.
a. Air Handled Each 50 Feet Main or Branch Duct: 1%.
b. Total Leakage Any Complete System: 5% of total air handled.

G. Duct Gauges:
1. Per SMACNA DCS

H. Plenum Gauges: Same as associated duct system.

I. Lined Duct: Dimensions on drawings indicate open inside dimensions. Add lining thickness when fabricating.

PART 3 EXECUTION

3.1 INSTALLATION

A. Assemble and install ductwork in accordance with SMACNA standards, to achieve airtight and noiseless systems; capable of performing each indicated service.
   1. Align ductwork accurately at connections.
   2. Support ducts rigidly with suitable ties, braces, hangers and anchors which will hold ducts straight, plumb and free of sags and vibration.

B. Electrical Equipment Spaces:
   1. Do not run ductwork through or over transformer vaults and other electrical equipment.

C. Metal Duct Support:
   1. Support ductwork from building structure where not otherwise indicated.
      a. Anchor with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps or special beam clamps.
   2. Support vertical ducts, at 12-foot spacing, by attachment to adjacent vertical structural surfaces or by direct bearing at floor penetrations and similar locations.
   3. Support horizontal ducts, located against structural walls and other similar adjacent vertical surfaces, at 8-foot spacing for ducts up to 40 inches horizontal dimension and 4-foot spacing for larger ducts.
   4. Hang horizontal rectangular ducts from overhead structure, at 10-foot spacing for larger ducts.
   5. Arrange hangers, supports and duct rests to permit free, unrestrained and noiseless expansion and contraction of duct.
   6. Where duct lining is not used, vertical members may be fastened to duct sides with sheet metal screws.
   7. Where duct lining is used, do not puncture sheet metal but loop strap iron under duct to support duct.

D. Openings:
   1. Provide openings in ductwork to accommodate thermometers and controllers.
   2. Provide pitot tube openings for testing of systems; complete with metal cap with spring device or screw to ensure against air leakage.
   3. Where openings are provided in insulated or lines ductwork, install insulation material inside metal ring.

E. Locate ducts with sufficient space around equipment to allow for normal operating and maintenance activities.

F. Provide sleeved opening where ducts pass through smoke, fire and sound walls.
   1. Seal space between duct and sleeve airtight with mineral wool.
   2. Provide duct flange to cover and retain mineral wool.

G. Where ducts pass through fire-rated walls, partitions, floors and ceilings, seal openings in accordance with NEC 300-21.

H. Drain Pockets:
   1. Provide formed drain pocket in outdoor air, dishwasher exhaust, and any duct carrying high-moisture air, sections with deep seal traps; connect to drainage system.

I. Connections:
   1. Connect duct to equipment with flexible fabric, sheet metal clips, screws and washers.

2. Make branch take-offs at 45° angle with area at trunk duct 1-1/2 times area of branch duct.
   a. Provide volume or splitter damper at each take-off.
   b. Prefabricated air scoops not acceptable.
   c. Form take-offs of same material as associated duct system.
3. Connect diffusers to low pressure ducts with 3-foot maximum length of flexible duct, held in place with strap or clamps.

J. Flexible Ductwork:
1. Maximum Length: 3 feet, in accordance with NFPA 90.
2. Install ductwork with minimum offsets and trim; not stretched between connection points.
3. Connect with factory-installed compression coupling each end or provide separate adjustable bond and clamp to secure duct to trunk fitting and to distribution unit fitting.
4. Where recommended by manufacturer, make connection with mastic duct tape and adjustable clamp.
   a. Seal end of flexible duct with tape so no insulations exposed.
5. Where metal ducts are lined, provide insulated flexible duct so no unlined metal duct is exposed.
6. Support ductwork as recommended by manufacturer' with wide sheet metal bends so area of flexible duct is not reduced at hanger.

K. Kitchen Exhaust Ducts:
1. Provide drain pockets at base of vertical risers and in horizontal runs over 15 feet long with provisions for cleanout.

3.2 ADJUSTING AND CLEANING

A. Cleaning:
1. Clean ductwork internally of dust and debris, unit-by-unit as installed.
2. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Temporary Closure:
1. At ends of ducts not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering until time connections are to be completed.

END OF SECTION

SECTION 23 3400

DUCTWORK ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. HVAC Contractor provide:
   1. Access Doors.
   2. Fire Dampers.
   3. Balancing Dampers.
   4. Backdraft Dampers.
   5. Flexible Duct Connections.

1.2 RELATED SECTIONS

A. DIVISION 01 - GENERAL REQUIREMENTS

B. SECTION 23 01 00 - BASIC MECHANICAL REQUIREMENTS

C. SECTION 23 31 00 - LOW VELOCITY DUCTWORK

D. SECTION 23 05 93 - TESTING, ADJUSTING & BALANCING

1.3 QUALITY ASSURANCE

A. Fire dampers shall be UL listed and constructed in accordance with UL Standard 555 Fire Dampers. Fire Dampers shall be rated for the protection required.

B. Fusible links on fire dampers shall be constructed to UL Standard 33, Fusible Links for Fire Protection Service, and so labeled for appropriate fire resistance and temperature.

C. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

D. Access doors shall be UL labeled, for rated protection required.

1.4 REFERENCE STANDARDS

A. Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.

B. Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

1.5 SUBMITTALS

A. Submit in accordance with Divisions 01.

B. Submit shop drawings of factory fabricated assemblies.

C. Submit samples of shop fabricated assemblies as requested.

D. Submit manufacturers' printed installation instructions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Air Balance

B. Vent Products

C. Ruskin

D. Substitutions: Items of same function and performance are acceptable in conformance with Division 01.

2.2 ACCESS DOORS

A. Fabricate rigid and close-fitting hinged doors of galvanized steel with sealing gaskets and quick fastening cam locking devices. For insulated ductwork, install minimum 1 inch thick insulation with sheet metal cover.

B. Provide hinges and sash locks for sizes up to 18 inch square, hinges and compression latches with outside and inside handles for sizes up to 24 inch x 48 inch.

C. Sizes:
1. For 6" to 8" ducts: 6" x 6" (1 latch and 2 hinges).
2. For 10" to 12" ducts: 10" x 10" (1 latch and 2 hinges).
3. For 12" to 16" ducts: 12" x 12" (2 latches and 2 hinges).
4. For 16" to 24" ducts: 16" x 16" (2 latches and 3 hinges).

D. Install at all fire dampers, smoke dampers, back draft dampers, control dampers and all temperature controls otherwise not accessible.

E. Ceiling, wall, and floor access panels must line up with duct access doors.

2.3 FIRE DAMPERS

A. Fire Rating:
1. Rated at 1-1/2 hours and so labeled.
2. Rated at 1-1/2 hours and so labeled for up to 2 hour walls.
3. Rated at 3 hours and so labeled for over 2 hour walls to 4 hour walls.

B. Multi-blade type or drop leaf types:
1. Type A acceptable for all grilles and all ducts over 18" in height.
2. Type B for ducts under 18" in height (100% free area). Contractor to verify job site clearances for style B dampers before submitting same.
3. Type C for all high velocity applications, round or oval; (100% free area).

C. All fire dampers to have 1/8: steel frames, 160 deg. F fusible link, 90 deg. blade openings, for vertical or horizontal mounting as shown on drawings, indicator arm, spring catch, with safety key slot locking device (locks dampers in place when closed). Fire dampers size shall be the same size as connecting ductwork. Duct liner shall be interrupted at each fire damper.

D. Provide separate or integral collars as required with wall retaining angles, on both sides of walls, floors, ceilings, etc.

E. All horizontal fire dampers to be spring loaded to close.

F. Contractor to verify location to make sure that dampers are in correct location in fire walls or ceilings before installation. Discuss location with General Contractor before installation.

G. Provide access panels at all fire dampers. Label these access panels "F.D." Access panels must be located to provide access to the fusible links and resetting devices. Grilles are acceptable as access.

2.4 DAMPERS

A. Fabricated of galvanized steel, minimum 16 gage, and provide with quadrants or adjustment rod and lock screw. Must be capable of tight closing, with felt or vinyl edges.

B. Fabricated splitter dampers of double thickness sheet metal to streamline shape, properly stiffened to avoid vibration. Size on basis of straight air volume proportioning.

C. Fabricated single blade dampers for duct sizes to 9-1/2 inch x 30 inch.

D. Fabricated multi-blade damper of opposed blade pattern with maximum blade sizes 6 inch x 72 inch. Assemble center and edge crimped blade in prime coated or galvanized channel frame with suitable hardware. Must be capable of tight closing, with felt of vinyl edges.

E. Fabricated multi-blade, parallel action gravity balanced backdraft dampers with blades a maximum of 6 inch width having felt or flexible vinyl sealing edges, linked together in rattle-free manner and with adjustment device to permit setting for varying differential static pressure.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Fabricate of neoprene coated flameproof fabric (U.L. approved) approximately 4 inch wide tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at 6 inch intervals.

2.6 APPLICATION

A. Provide access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Review locations prior to fabrication.

B. Provide 6 inch x 6 inch quick opening access doors for inspection at balancing dampers.

C. Provide fire dampers at locations shown, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Fire dampers shall be complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.

D. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing.

E. Provide balancing dampers on high pressure systems where indicated. Use splitter dampers only where indicated on Drawings.

F. Provide flexible connections immediately adjacent to equipment in ducts associated ducts associated with fans and equipment subject to forced vibration.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 23 3700

AIR INLETS AND OUTLETS

PART 1 GENERAL

1.1 RELATED SECTIONS

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

1.2 SECTION INCLUDES

A. HVAC Contractor provide:
   1. Diffusers
   2. Grilles and Registers

1.3 RELATED WORK

A. DIVISION 01 - GENERAL REQUIREMENTS

B. SECTION 23 01 00 - BASIC MECHANICAL REQUIREMENTS

C. SECTION 23 31 00 - LOW VELOCITY DUCTWORK

D. SECTION 23 34 00 - DUCTWORK ACCESSORIES

E. SECTION 23 05 93 - TESTING, ADJUSTING & BALANCING

1.4 QUALITY ASSURANCE

A. Make air flow tests and sound level measurements in accordance with applicable ADC equipment test codes and ASHRAE standards, and associated Air Balance Council (AABC).

B. Manufacturer shall certify cataloged performed and ensure correct application of air outlet types.

1.5 SUBMITTALS

A. Submit in accordance with Division 01.

B. Submit product data and shop drawings covering each item together with schedule of outlets, indicating size, type, quantity, configuration, and location of each.

C. Submit manufacturer's installation instructions.

1.6 JOB CONDITIONS

A. Review requirements of outlets as to size, finish, and type of mounting prior to submitting shop drawings and schedules of outlets.

B. Check location of outlets and make necessary adjustments in position to conform with architectural features, ceiling symmetry, and lighting arrangement.

1.7 REGULATORY REQUIREMENTS

A. Air Diffusion Council, ADC.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, ASHRAE:
   1. Make air flow tests and sound level measurements in accordance with ACC Equipment Test Codes and ASHRAE Standards.

C. National Fire Protection Association, NFPA:
   1. NFPA 90A: Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 90B: Warm Air Heating and Air Conditioning Systems.

PART 2 PRODUCTS

2.1 CHARACTERISTICS

A. Rate units in accordance with ADC standards.
   1. Base air outlet application on space noise level of NC 35 maximum.

B. Supply outlets with sponge rubber seal around edge.

C. Baffles to direct air away from walls, columns or other obstructions within radius of diffuser operation.

D. Plaster frame for diffusers located in plaster surfaces.

E. Provide boots of same manufacturer as grille or register; fitted with equalizer deflector or diffuser plate.

F. Diffusers in kitchen, locker rooms, food service areas to be aluminum construction - All other areas to be steel.

2.2 SUPPLY DIFFUSERS

A. Square, Rectangular: Three cone face supply type, steel or aluminum square with removable hinged face for access to inner accessories, 4-way adjustable air discharge pattern. No face mount pattern controls.
   1. Acceptable Manufacturers:
      a. Krueger, Inc.
      b. Titus Mfg. Corp.
      c. Metalaire
      d. Price
   2. Frame compatible with ceiling type.
   3. Finish: Baked enamel.

2.3 GRILLES

A. Return And Exhaust Grille(G1): Aluminum frame and core, egg-crate type, ½ inch by ½ inch by ½ inch removable snap-in grid, 1-1/4 inch border frame, concealed fasteners.
   1. Acceptable Manufacturers:
      a. Titus : 45F
      b. Price : 85
      c. Krueger : ECG545
      d. Metalaire : CC45
   2. Finish: Brushed satin.

PART 3 EXECUTION

3.1 INSTALLATION

A. Coordinate with other work, including ceiling layout, ductwork and ductwork accessories , to interface installation of air diffusers properly with other work.

B. Install items in accordance with manufacturers' printed instructions.

C. Paint ductwork visible behind air outlets and inlets matt black.

D. Diffusers:
   1. At each duct drop or take-off to individual diffuser, locate accessible volume damper independent of volume damper integral with diffuser.
   2. Support diffusers adequately for type of ceiling receiving diffusers.
   3. Adjust diffuser air pattern to provide draftless uniform air distribution.
   4. Achieve air pattern indicated on Drawings, by using sheet metal blank-offs, flat black painted finish, on back side of louver.

E. Grilles and Registers:
   1. Secure overlapping frame of register or grille to screen or flange with countersunk screws.
   2. Locate wall registers and grilles minimum 6 inches below ceiling.
   3. Locate separate accessible balancing volume damper at each register or grille in addition to control damper integral with register or grille.
   4. Adjust registers and grilles to provide draftless uniform air distribution.
   5. Linear Register, Grille:
      a. Accurately align boot with finished wall.
      b. Flange tight to finished surface when diffuser is snapped or locked in place.
      c. Boot support mountings adjustable.
      d. Individual volume dampers located in branch duct connections to boot.
   6. Forced Air Base Board Grille:
      a. Notch back plate at floor openings.
      b. Anchor plate to wall or screen and floor.
      c. Install front plate, end caps and corner sections.

3.2 FIELD QUALITY CONTROL

A. Test operate installed outlets and inlets to demonstrate compliance with specifications.

3.3 AIR OUTLET AND INLET SCHEDULE

A. See Schedule on Drawings.

END OF SECTION

SECTION 26 0100

GENERAL PROVISIONS, ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Basic Electrical requirements specifically applicable to Division 26 Sections, in addition to Division 01 - General Requirements.

B. General and procedural requirements for work specified under Sections of Division 26 shall be as required herein.

1.2 RELATED SECTIONS

A. DIVISION 03 - CONCRETE.

B. DIVISION 09 - FINISHES.

C. DIVISION 23 - MECHANICAL.

D. DIVISION 26 - ELECTRICAL.

E. Section 26 05 00 - BASIC MATERIALS AND METHODS, ELECTRICAL.

1.3 CONTRACTOR'S RESPONSIBILITY

A. Contractor agrees to assume responsibility for liability, workmanship, and quality of materials concerning work sublet to others. Before contract is sublet, submit in writing the names of proposed subcontractor and obtain written approval therefor.

B. Work shall be installed under the constant supervision of a qualified superintendent and by skilled and qualified electricians.

C. Materials shall be new and unused.

1.4 CODES AND FEES

A. Install all work in accordance with the applicable provisions of the local codes, the National Electrical Code, and the National Electrical Safety Code.

B. Electrical materials shall have Underwriters' approval where applicable, and shall be so labeled where UL labeling is customary.

C. Electrical equipment shall conform to applicable NEMA Standards whether specified hereinafter or not, and to other applicable Standards which may be specified hereinafter.

D. The Contractor shall be responsible for obtaining local permits, payment of fees and notification for inspection by code authorities consistent with the schedule of work.

1.5 ACCURACY OF DATA AND DRAWINGS

A. Drawings and Data: Electrical drawings are generally diagrammatic, and where not dimensioned or detailed, indicate approximate locations and general arrangements of electrical work. All electrical work offsets, rises, and fittings are not necessarily shown; however, provide these as required by the conditions involved.

B. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND STRUCTURAL DRAWINGS: AND FROM ACTUAL MEASUREMENTS MADE BY ELECTRICAL SECTION OF EACH EXISTING BUILDING AND EACH EXISTING STRUCTURE INVOLVED.

C. Equipment NOT furnished by Electrical Section but requiring electrical connections: from other Sections and others furnishing this equipment, determine exact electrical connection requirements therefor; locations and arrangements of electrical connections indicated for this equipment are APPROXIMATE ONLY.

D. Capacities of feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices indicated to be furnished and installed by Electrical Section for electrically operated equipment, regardless of who furnishes and/or installs that equipment, are based upon the average horsepower and/or electrical ratings. HORSEPOWER AND/OR ELECTRICAL RATINGS OF ELECTRICALLY OPERATED EQUIPMENT INDICATED ON ELECTRICAL DRAWINGS SHALL NOT LIMIT SIZES OF THE ELECTRICALLY OPERATED EQUIPMENT AND CAPACITY OF THE ELECTRICAL WORK THEREFOR.
   1. Before commencing electrical work for electrically operated equipment, Electrical section shall: check horsepower and/or electrical rating of each individual electrically operated equipment items, regardless of who furnishes and/or installs that equipment; and adjust sizes of all applicable feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices furnished by Electrical Section, as required to provide proper protection and satisfactory operation of the electrically operated equipment actually installed. This includes increasing to next larger size, or decreasing to next smaller size, all feeders, circuit breakers, starters, switches, protective devices, and other electrical devices involved, as required to match capacities of corresponding electrically operated equipment actually installed, except that no sizes shall be decreased without approval.

E. Switches, circuit breakers, motor starters, protective devices, and other electrical devices furnished by other Sections and by others for installation and/or wiring by Electrical Section, are specified elsewhere to have adequate capacities to serve the electrically operated equipment for which they are furnished. However, BEFORE installing and/or wiring each of these devices, Electrical Section shall check each individual device's electrical rating with the horsepower and/or electrical rating of the corresponding electrically operated equipment actually installed, regardless of who furnishes and/or installs the devices and equipment. Electrical Section shall not install and/or wire any device that is found to be the incorrect size, and shall see to it that correctly sized devices are furnished by the applicable Section and other applicable persons in all cases.

F. The intent and requirement of the above is to obtain a coordinated electrical system and all of the above shall be done by Electrical Section as part of the contract, at no extra cost to the Owner.

1.6 ELECTRICAL WIRING FOR EQUIPMENT OF OTHER SECTIONS

A. Electrical wiring of every description required to operate all equipment furnished by other Sections shall be done by the Electrical Section, except as otherwise specified hereinafter. Read carefully all other Sections in which electrically operated equipment is specified, and include in the electrical work all electrical wiring required for the proper operation of the equipment, whether indicated on the electrical drawings or not. Coordinate the Electrical section work with that of all other Sections that furnish equipment requiring electrical connections.

B. All control devices required to operate the equipment shall be furnished by the Section that furnishes the equipment, unless otherwise specified. All control devices which are not factory mounted on the equipment and require electrical connections ONLY shall be installed by the

Electrical Section. All control devices which are not factory mounted on the equipment and require piping, linkage, remote bulb, or other mechanical connections as well as electrical connections shall be installed by the Section that furnishes the equipment involved, ready for electrical connections.

C. Outlet locations indicated on the electrical drawings for motors, controls, and other electrically operated items of other Sections are APPROXIMATE ONLY, as the actual wiring requirements are not necessarily identical for the various makes of each item of equipment involved. However, the Electrical Section shall locate all outlets and arrange all wiring to properly serve the equipment ACTUALLY INSTALLED, generally as indicated on the electrical drawings, but EXACTLY in accordance with rough-in sheets and/or wiring diagrams furnished by the other Sections involved.

D. The necessary wiring diagrams shall be furnished by the Section that furnishes the equipment involved, and after these are approved, do all wiring accordingly.

E. Wiring NOT included: Wiring which is factory installed on equipment.

F. Wiring included: Generally equipment of other Sections requiring wiring, includes but shall not be limited to the following items:
   1. Plumbing: water heater.
   2. Special construction: equipment connections.
   3. Special type wire (other than type MTW): If any of this is required for other Divisions, that wire shall be furnished by the other Divisions and installed under this Division.

1.7 EQUIPMENT LISTS, SHOP DRAWINGS, SAMPLES AND SUBMITTALS

A. Submit under provisions of Section 01 33 00 and General Conditions.

B. Submit to the Architect for approval, within 30 days after receipt of Notice to Proceed with the work, a complete list of materials, equipment and accessories proposed for use, including complete descriptions and specifications of any proposed substitutions, manufacturer's shop drawings, and roughing-in work. Submit five (5) copies of all items for approval and furnish additional copies if required for installation purposes.

C. Submission material and all shop drawings shall be marked with the respective mark number or identification of the equipment shown on the drawings or specified. The shop drawings shall list all ratings, capacities, accessories, and other pertinent data to show that the proposed item is as called for and as specified.

D. Shop drawings shall show sizes and details of required concrete and steel machine foundation, locations of anchor bolts, physical dimensions of equipment, capacity characteristics of equipment, and all other work pertinent to details. Concrete foundations are specified under "Concrete Work" section, but steel racks or stands for mechanical apparatus shall be furnished and installed as part of the mechanical work.

1.8 QUALITY CONTROL

A. Comply with Section GENERAL CONDITIONS. In addition, shall be the manufacturer’s latest standard or current model for which replacement parts are readily available.

B. Qualifications: Where qualifications are specified in individual specification section, provide required data with Subcontractor list.

C. Provide complete coordination study to Owner and Engineer.

1.9 GUARANTEE

A. Comply with Section GENERAL CONDITIONS.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Install in accordance with applicable manufacturer's drawings and recommendations.

B. Identification of circuits and equipment: Identification designations shall correspond to those indicated on electrical drawings and as specified in corresponding articles describing the equipment.

3.2 TEMPORARY LIGHTS AND POWER

A. Provide temporary lights and power. Lights shall be one pigtail socket and 150W lamp for each 500 sf building space, minimum one per room. Power outlets shall be provided as coordinated with construction. Temporary electricity charges shall be paid by the Contractor.

B. Remove all temporary lights and conductions prior to calling for final inspection.

3.3 PROTECTION AND CLEANING

A. Work shall be protected at all times. Conduit openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered, if necessary, to protect against dirt, water, chemical or mechanical damage or defacement. The installation of fixtures liable to damage shall be coordinated with installing UL fire protective barriers and ceiling systems. Clean all fixture glassware and reflectors and clean and polish all other surfaces that are not painted so that they present a new and acceptable appearance.

B. Electrical equipment rooms shall be cleaned up prior to energizing equipment and shall not be used for storage or other purposes after power is applied to the electrical equipments.

3.4 OPERATING INSTRUCTIONS

A. Furnish the services of a competent man (or men) to instruct the Owner’s personnel in the proper operation and maintenance of all equipment, for a period of not less than two working days.

B. Furnish and deliver to the Owner three sets of operating instructions for all equipment installed under this contract, including shop drawings, piping diagrams, wiring diagrams, maintenance recommendations and information concerning replacement parts.

3.5 TEST, INSPECTIONS, ADJUSTMENTS, AND CLEANUP

A. Furnish suitable testing equipment, give the Engineer and all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal electrical work until all necessary inspections have been made and all required tests have been approved by the Owner's Representative and all applicable authorities.

B. Put entire system in operation, test all equipment, remedy all defects, and make all necessary adjustments. Demonstrate that the entire system functions satisfactorily, as specified, as indicated, and as approved.

END OF SECTION

SECTION 26 0500

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:
   1. Raceways.
   2. Building wire and connectors.
   3. Supporting devices for electrical components.
   4. Electrical identification.
   5. Concrete equipment bases.
   6. Cutting and patching for electrical construction.
   7. Touchup painting.

1.2 RELATED SECTIONS

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

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

F. GRS: Galvanized Rigid Steel.

G. AWG: American Wire Gage.

H. PVC: Polyvinylchloride, UV light resistant.

1.4 SUBMITTALS

A. Product Data: For electricity-metering equipment and basic electrical materials as described in this section.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering and distribution equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Provide chases, slots, inserts, sleeves, and openings as required or indicated for conduits passing through concrete and masonry construction. Coordinate with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
   1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
   2. Sleeves through concrete walls, concrete columns, and concrete beams shall be IMC or GRS, flush with finished concrete surfaces.
   3. Sleeves for all exposed conduits passing through floors (except slabs on ground) where water on floor can pass through the opening shall be galvanized IMC pipe or GRS extending two inches above finished floor, and flush with slab below. Other sleeves may be RNC.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.
   1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
   2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

G. Junction boxes must be accessible in the finished project. Provide gypsum access panels as required.

H. Coordinate the location and installation of electrical items adjacent to mechanical and other equipment to permit operating access doors and panels. Do not cover up equipment model numbers and nameplates.

PART 2 PRODUCTS

2.1 RACEWAYS

A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.

B. FMC: Zinc-coated steel.

C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.

D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

F. Raceway Fittings: Specifically designed for the raceway type with which used.

G. GRS: NEMA C80.1 Galvanized rigid steel with threaded fittings.

2.2 CONDUCTORS, 600 VOLTS AND LESS

A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

B. Conductors, Larger Than No. 10 AWG: Stranded copper.

C. Insulation: Thermoplastic, rated at 75 deg C minimum. Type THHN and THHN/THWN as required for conditions related to Heat (H) and Moisture(W).

D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated. Branch circuit wire minimum size is #12 AWG.

E. Signaling, sound communications alarm, indicating and other special system wire shall be copper of the type specified hereinafter with the equipment or system and indicated or as recommended by equipment manufacturer.

2.3 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.
   1. Channel Thickness: Selected to suit structural loading, minimum 12 gauge.
   2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

2.4 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
   1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.

2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick. T&B WDT Series or approved equal.

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line. T&B NAF 708, Yellow, or approved equal.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.5 CONCRETE BASES AND HOUSEKEEPING PADS

A. Concrete Forms and Reinforcement Materials: As specified in Division 03 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 03 Section "Cast-in-Place Concrete."

2.6 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.7 PULL BOXES AND JUNCTION BOXES

A. General: Pull boxes and junction boxes shall be of the types and minimum sizes indicated, or as required for the conditions involved where types and sizes are not indicated. Before installation, check proposed locations of boxes with the architectural, structural, and mechanical drawings, and locate each box so that it will be accessible in the finished project.

B. Above Ground Boxes and Gutters: These shall be galvanized steel of at least Code gauge for each size involved, and of weatherproof construction where exposed to weather.

C. Underground pullboxes and junction boxes for secondary circuits and controls and communications lines shall be precast polymer concrete boxes style PG/LB as manufactured by Strongwell or approved equal. Boxes shall include base, body and cover. Minimum size shall be 11" x 18" interior dimensions, 24" depth. Dimensional sizes shall be increased where necessary to comply with NEC conduit diameter to width/length ratios for turns and straight runs.

2.8 OUTLET BOXES

A. General: Outlet boxes and covers therefor shall be steel or cast ferrous metal with zinc or other suitable metallic rustproof coating, or cast aluminum, all of the proper sizes and types to accommodate the conduits, conductors, connections, devices, fixtures, architectural conditions, and structural conditions involved.

B. Special Box Requirements:
1. Exposed-to-weather outlet boxes shall be cast metal, with threaded hubs and gasketed covers, all strictly weatherproof.
2. Floor boxes for floor outlet devices shall be Steel City Series 88, with floor adjusting rings and appropriate type floor plates for attaching the outlet devices thereto (does not apply to underfloor duct system).

C. Installation:
1. Before installation, check proposed location of each outlet box with the architectural, structural, and mechanical drawings, and locate each outlet box so that it will be accessible and interference free in the finished project.
2. Set each concealed box flush with finished surfaces, and so that exposed finished surfaces will not be marred.
3. Install each wall switch on the knob side of the door involved. Before placing each wall switch box, verify the applicable door swing with the architectural drawings, and locate the wall switch box accordingly.
4. Where equipment is served by exposed flexible cords, locate the outlet box as near as practicable to the equipment connection point, to minimize flexible cord length.

2.9 FUSES

A. General: Provide fuses of the indicated types and sizes, in place, for each device requiring fuses. Unless otherwise indicated, fuses shall be dual element non-renewable delay type. Fuses shall be Bussman, Littlefuse, General Electric.
1. Spare Fuses: Furnish three spare fuses of each size and type required for the electrical system, deliver these to the Owner's representative in a suitable clearly labeled box, obtain signed receipt for delivery.

2.10 DISCONNECT SWITCHES, MOTOR STARTERS, AND SEPARATE CIRCUIT BREAKERS

A. General: Except as otherwise specified below, Electrical Section shall provide disconnect switches, circuit breakers, and motor starters for all motors and other electrically operated equipment, regardless of who furnishes and/or installs that equipment. Types and locations of these devices shall be as indicated, or as required where types and/or locations are not indicated.
1. These devices which are located on other equipment shall be as specified under the corresponding headings; these devices NOT located on other equipment shall be as specified below, and shall be separately mounted.
2. Separately mounted disconnect switches, circuit breakers, and motor starters shall be Cutler-Hammer, Square D, Allen-Bradley, Seimens, or as approved. Enclosure

types shall be: NEMA 3R for devices in mechanical rooms and where exposed to weather; NEC required type for devices in other special locations; and NEMA 1 type for devices in other inside locations. Each circuit breaker and each disconnect switch, including those integral with motor starters, shall have padlocking means.

3. All terminals for disconnect switches, circuit breakers and motor starters shall be rated and marked for 75 degrees C terminations.

B. Disconnect Switches: These shall be: non-fused heavy duty type safety switches where overcurrent protection is not required; and fused heavy duty type safety switches where overcurrent protection is required; except that other suitable properly rated switches may be used for fractional hp motors and other small loads.

C. Circuit Breakers: These shall be molded case type. Breakers shall be quick make, quick break type with trip indications shown and with common trip handle on all multipole breaker. Where separable from panelboards and switchgear provide NEMA 1 enclosure with handle.

D. Manual Motor Starters: These shall have neon motor running pilot lights and proper sized overload protective devices for the motors involved; and shall be surface mounted in equipment rooms and unfinished areas, and flush mounted in finished area. Where manual motor starters are not indicated, small manually controlled motors shall be controlled directly by the panelboard circuit breakers.

E. Magnetic Motor Starter: Each motor of 1/8 hp or larger shall be provided with thermal overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, unless otherwise specified, the protective device shall be of the manually reset type. Magnetic starters shall be NEMA size and type including the NEMA withstand ratings, with the automatic-control device actuating the pilot-control circuit. Each magnetic starter shall have a built in control circuit transformer to supply 120 volts to the control circuit. Each magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Two auxiliary contacts shall be a part of the starters. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with approved wiring diagram. All controls shall be 120 volts or less unless otherwise indicated. All motors with a rating of 50 hp and above shall have autotransformer reduced voltage starters; motors less than 50 hp shall be line voltage starters.

F. Identification of Separately Enclosed Devices: Identify each separately enclosed circuit breaker, disconnect switch, magnetic motor starter, and manual motor starter, by attaching to the device cover a metal or plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device.

G. Devices Furnished by Other Sections or Others:

1. 3/4 hp and small single phase roof mounted fans: If the disconnect switches for these are furnished with and factory mounted on the equipment; Electrical Section shall connect to fan motors and/or switches, as required. Verify that disconnects are furnished by others.

2.11 DEVICES

A. General:

1. Wiring devices shall be Bryant, Hubbell, Arrow-Hart, Leviton, Sierra, Eagle Specification Line, General Electric, or other makes as approved or as specified below. Type of wiring devices required for this project shall be as indicated on the

drawings, or suitable for the application involved if type is not indicated; qualities, ratings, and other requirements of wiring devices shall be as specified below. All wiring device types specified below may not necessarily be required for this project. disregard specifications for devices which are neither indicated nor required for this project.

2. Receptacle configurations shall conform to NEMA standards.
3. Exposed finish shall be: for each device with a plastic plate, same color as that of plate; for devices with stainless steel plates, brown; and for all other devices, brown or black.

B. Devices: Qualities, ratings, and other requirements shall be:
1. Wall switches: 20A 120-277VAC, single or double pole, 3 or 4 way, locking or toggle, as applicable; Bryant 4901 series; Hubbell 1221 series; A-H 1991 series. Where indicated as WEATHERPROOF, the above specified switch, with Bryant 7420, Hubbell 7420, or A-H 7420 spring door cover.
2. Duplex receptacles: (Commercial) 20A 125 volt, 2 pole, 3 wire grounding; Bryant 5362; Hubbell 5362; A-H 5362. Where indicated as WEATHERPROOF the above specified duplex receptacle with Taymac or equal hinged positive close cover to envelope receptacle and plug.
3. Isolated ground receptacles: 20A, 125 volt, 2 pole, 3 wire duplex isolated ground type; Hubbell No. IG 5362; Bryant 5362-IG; A-H IG 5362.
4. Ground fault circuit interrupter receptacles: (Commercial) 20A 125 volt feed through duplex 5ma sensitivity type with test and reset buttons; A-H GF 5342, Bryant GFR53FT, Hubbell GF5362. Where indicated as WEATHERPROOF, the above specified receptacle with Taymac or equal hinged positive close cover to envelope receptacle and plug.
5. Single Receptacle: (Commercial) 20A 125 volt, 2 pole, 3 wire grounding; Bryant 5361, A-H 5361, Hubbell 5361 or approved equal. Single receptacles: 30A, 125 volt, 2 pole, 3 wire grounding; Hubbell No. 9308 A-H 5716N, Bryant 9530-FR.
6. Single receptacles: 20A, 250 volt, 2 pole 3 wire grounding; Bryant 5461; Hubbell 5461; A-H 5461.
7. Heavy duty receptacles: 250 volt, 2 pole, 3 wire grounding, 30A or 50A as required; Bryant 9630FR and 9650FR; Hubbell 9330 and 9367; A-H 5700 and 5709.
8. Other devices not specified above; as indicated on the drawings.

C. Device Plates: Unless otherwise specified or inapplicable to the devices involved, plates shall be: All device plates shall be stainless steel, device body shall be brown except where color is noted for specific use. Device plates for isolated ground receptacle shall be the same as others except a symbol shall be on the outlet body indicating isolated ground.

PART 3 EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations. All switchboards, floor panelboards and transformers shall be belted in place at all manufacturer mounting holes, minimum two per section. Anchor bolts shall be embedded or undercut type. Shot anchors are not permitted.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY APPLICATION

A. Use the following raceways for outdoor installations:
   1. Exposed: IMC.
   2. Concealed: IMC.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment: LFMC.
   6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4, unless otherwise indicated.
   7. Service Conductors: GRS.

B. Use the following raceways for indoor installations:
   1. Exposed: EMT.
   2. Concealed: EMT.
   3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
   4. Damp or Wet Locations: IMC.
   5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.
   6. Service Conductors: GRS.
   7. Embedded in Concrete: RNC or GRS, PVC or bituminous coated.

3.3 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Use temporary raceway caps to prevent foreign matter from entering.

D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

E. Use raceway fittings compatible with raceways and cables and suitable for use and location. Provide suitable adapters where RNC are coupled to metallic conduits. Solvent weld all joints between RNC materials.

F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
   3. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
   4. Transition from RNC to rigid steel elbow with rigid steel conduit, or IMC before rising above floor. Conduit extension to box shall be IMC or GRS.
   5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

H. Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

J. Prior to pulling wire, keep all open ends of conduit plugged, and swab out all trapped conduits in which moisture has collected.

K. Each branch circuit conduit run shall include a green bonding conductor sized based on the largest circuit in the run but no smaller than #12 AWG.

L. Coordinate with all disciplines prior to installing equipment. No mechanical piping or ductwork shall be installed above electrical equipment (panelboards, MCC, switchboards, switchgear, disconnects, starters, etc.). Contact Engineer or Architect upon identifying potential problem and prior to installing equipment (mechanical or electrical). Provide template of mechanical and electrical layout with actual equipment dimensions prior to installation.

M. Four hour fire walls shall not be penetrated with conduit runs. Raceways shall be routed under the floor in these areas. UL listed fire stops shall be provided for all 2 and 3 hour wall penetrations.

N. Conduit size 2 ½" and below shall be installed tight to structure, larger sizes shall include seismic bracing and shall be fastened to supports with fasteners as permitted in seismic Level 3 areas.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

E. No. 8 and larger, stranded; No. 10 and smaller, solid.

F. Whether indicated or not, provide low voltage (less than 120 volts) wiring for kitchen equipment controls and other purposes as required for the complete electrical system. Mechanical HVAC controls shall be coordinated with Division 15.

G. Wiring shall be run in raceway, unless otherwise indicated.

H. Conductor Joints and Splices: Make these with suitable solderless connectors, in the various boxes, gutters, and similar locations, but not in any conduit. Leave enough wire slack to permit at least one splice or joint to be remade in case of fault.
   1. Branch circuit, control, and special system wire joints: use Ideal, Buchanan, 3M, or similar tool-applied to twist-on type connectors.
   2. All other wire joints: use Ilsco tin plated aluminum type pressure connectors, or suitable brass, bronze, or copper pressure type connectors.
   3. Insulate all joints and splices with suitable insulating sleeves or caps integral with the connectors or separate therefrom, or with vinyl plastic insulating tape.

I. MC Cable is not acceptable.

3.5 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

D. Branch circuit conduit routings: except where detailed or dimensioned, the indicated branch circuit conduit routings are generally diagrammatic, and are intended to show the required circuitry from panelboards to outlets. However, if necessitated by job conditions, deviations from the indicated routings may be made, provided that regardless of the actual installed arrangement of the conduits: each outlet marked with the same circuit number is connected to the same corresponding numbered circuit; outlets are switched and controlled as indicated; and no home run is brought into any switch box unless otherwise indicated.

3.6 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.7 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing MAY NOT be used instead of malleable-iron hangers raceways serving lighting and receptacle branch circuits above suspended ceilings or for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
   1. Wood: Fasten with wood screws or screw-type nails.
   2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
   3. New Concrete: Embedded anchor bolts placed with equipment template or undercut expansion bolts.
   4. Existing Concrete: Undercut Expansion bolts.
   5. Steel: Welded threaded studs or spring-tension clamps on steel.
      a. Field Welding: Comply with AWS D1.1.
   6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
   7. Light Steel: Sheet-metal screws.
   8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.8 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:
   1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
   2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
   3. Colors: As follows:
      a. Fire Alarm System: Red.
      b. Security System: Blue and yellow.
      c. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
   1. Phase A: Black.
   2. Phase B: Red.
   3. Phase C: Blue.

H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
   1. Phase A: Yellow.
   2. Phase B: Brown.
   3. Phase C: Orange.

I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.9 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

3.10 CONCRETE BASES

A. Construct concrete bases not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.11 GROUNDING

A. Ground electrical equipment and conductors as required by NEC and other applicable electrical codes.
   1. Panelboards served by individual transformers: ground panelboard neutral busses to building grounding system.
   2. All metallic cable sheaths, cable shields, metal conduit, transformer cases, cabinets and pedestals shall be made electrically secure to form a continuous system and shall be grounded.
   3. The neutral shall only be grounded at the panelboard or service grounding device. Grounding conductors shall be continuous between the service and the driven grounding electrode or other grounding electrode as permitted in Part H of NEC Article 250.
   4. All conduits shall have code sized green equipment grounding conductors with diameter based on the largest circuit in each conduit.

3.12 EXCAVATION AND BACKFILL

A. Excavate and backfill as required for the electrical work. Cut bottoms of trenches to the proper lines and grades to provide firm and continuous support for the underground electrical work, and to provide 24 inch MINIMUM depth from finished grade to tops of all exterior underground electrical work. Sheet and brace excavations as required to protect personnel and adjacent structures.

B. After the underground electrical work has been installed and approved, place all backfill in 8 inch maximum thickness loose layers, and compact each layer to at least the density of the adjacent undisturbed site soil, using pneumatic or other suitable power tampers. Mass backfilling (backfilling without tamping) is prohibited.

C. Warning tape for buried electrical work: install detectable warning tape directly over every device by burying tape as close to the surface as possible but no less than six inches beneath finished grade. Tape shall be Reef Industries, Inc., “Terra Tape D”, Thomas Betts NAF-0708 or equal as approved, composition metallized foil-plastic film laminate bearing imprint describing the type of buried electrical work. All materials shall be specifically formulated for prolonged use underground.

3.13 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.14 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.15 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:
   1. Raceways.
   2. Building wire and connectors.
   3. Supporting devices for electrical components.
   4. Electrical identification.
   5. Concrete bases.
   6. Electrical demolition.
   7. Cutting and patching for electrical construction.
   8. Touchup painting.

B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
   1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
   2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
   3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
   4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
   5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.16 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
   1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
   2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
   3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.17 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, water, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 0526

GROUNDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide grounding conductors for extending the existing building electrical system using methods and materials that comply with this section.

B. Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1.2 RELATED SECTIONS

A. Section 26 01 00 - BASIC MATERIALS AND METHODS.

PART 2 PRODUCTS

2.1 GROUNDING CABLES

A. Materials:
   1. Grounding conductors shall be tinned soft drawn annealed copper, size per NEC 70.

B. Joints and Splices: Make these with suitable copper compression connectors, in manholes and pull boxes, but not in any conduit. Leave enough wire slack to permit at least one splice or joint to be remade in case of damage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide ground conductor in each electrical circuit raceway.

END OF SECTION

SECTION 26 0536

CABLE TRAYS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cable trays and accessories.

B. Firestopping within (not around) cable trays.

1.2 RELATED SECTIONS

A. Division 07 - Firestopping: Firestopping around cable trays.

B. Section 26 05 26 - GROUNDING.

C. Section 26 05 48 - ELECTRICAL SUPPORTS

1.3 REFERENCES

A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2005a.

C. NEMA VE 1 - Metallic Cable Tray Systems; National Electrical Manufacturers Association; 2002.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.

1.4 SUBMITTAL

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for fittings and accessories.

C. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.

D. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experiences, and with service facilities within 100 miles of Project.

D. Products: Listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

1.6 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this section.

PART 2 PRODUCTS

2.1 MANUFACTURERS: Wire Basket Type:

A. Equal to wire mold; (www.wiremold.com): CF 105/450 cablofil wire cable tray.

2.2 WARNING SIGNS

A. Engraved Nameplates: ½ inch (13 mm) black letters on yellow laminated plastic nameplate, engraved with the following wording: "WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!"

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Install metallic cable tray in accordance with NEMA VE 1.

B. Support trays in accordance with Section 26 05 48. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports.

C. Use expansion connectors where required.

D. Provide firestopping under provisions of Section Firestopping to sustain ratings when passing cable tray through fire-rated elements.

E. Ground and bond cable tray under provisions of Section 26 01 00.
   1. Provide continuity between tray components.
   2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
   3. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.
   4. Connections to tray may be made using mechanical or exothermic connectors.

F. Install warning signs at 50 feet (1500 mm) centers along cable tray, located to be visible.

END OF SECTION

SECTION 26 0548

ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Seismic restraints for mechanical and electrical component seismic design requirements listed in Section 1621 of the IBC.
   3. Construction requirements for concrete bases.

1.2 RELATED SECTIONS

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

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

D. IBC: The correct resin of the International Building Code.

E. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

1.5 PROJECT CONDITIONS

A. IBC Projects Refer to structural notes on drawings for project conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

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

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
   1. Available Manufacturers:
      a. Cooper B-Line; a division of Cooper Industries.
      b. ERICO International Corporation.
      c. Allied Support Systems; Power-Strut Unit.
      d. Thomas & Betts Corporation.
      e. Unistrut; Tyco International, Ltd.
   2. Finishes:
      a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
      b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
      c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.
   3. Channel Dimensions: Selected for structural loading and applicable seismic forces.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
   1. Available Manufacturers:
      a. Allied Support Systems; Aickinstrut Unit.
      b. Cooper B-Line; a division of Cooper Industries.
   2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
   3. Fitting and Accessory Materials: Same as channels and angles.
   4. Rated Strength: Selected to suit structural loading and applicable seismic forces.

D. Raceway and Cable Supports: As described in NECA 1.

E. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

H. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Available Manufacturers:
         (1) Hilti, Inc.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Available Manufacturers:
         (1) Cooper B-Line; a division of Cooper Industries.
   3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
   1. Available Manufacturers:
      a. Amber/Booth Company, Inc.
      b. Mason Industries, Inc.
   2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
   3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections Reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
   4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
   5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
2. Secure raceways and cables to these supports with two-bolt conduit clamps single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. All conduits, whether individual or grouped, shall be mounted as tight to structure as possible.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.6 LIGHT FIXTURE

A. Installation:
   1. Pendant fixtures: In addition to the normal chain or conduit or cable mounting, each pendant fixture shall have one zinc coated, high strength, steel rope cable with connections designed for cable service run between fixture and structure above.
   2. Recessed lay-in type fluorescent fixtures shall be secured to the ceiling tee bar by running a self-tapping screw through the vertical part of the tee bar main runners only and the fixture at each of the four corners of the fixture. In addition, support the fixture from the structure above with two 12 gauge steel wires attached to the fixture at diagonally opposite corners.
   3. Surface and wall mounted fixtures shall be secured with a minimum of four bolts or screws. Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, slab, stud or other support added for this purpose. Do not secure or support the weight of the fixtures from gypboard on walls or any ceiling material. Fixtures attached to ceiling tees shall be attached to the main runners only with at least two positive clamping devices. Rotational spring catches or other clips shall not be used. A 12 gauge steel wire shall be attached to each clamping device and to the structure above. Chain hangers shall be secured to the fixture and the structure with screws or bolts. Do not use clips or fasteners.

END OF SECTION

SECTION 26 5000

LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The work required under this Section includes all work necessary to provide a complete lighting system.

1.2 RELATED SECTIONS

A. DIVISION 31 - EARTHWORK.

B. DIVISION 03 - CONCRETE.

C. DIVISION 09 - FINISHES.

D. DIVISION 23 - MECHANICAL.

E. Section 26 01 00 - GENERAL PROVISIONS, ELECTRICAL.

F. Section 26 05 00 - BASIC MATERIALS AND METHODS, ELECTRICAL.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

PART 2 PRODUCTS

2.1 GENERAL

A. Lighting fixtures shall be those specified on drawing schedule or approved equivalents thereof, each complete with drivers, hangers, and all necessary devices. Fixtures types specified correspond to those indicated on the drawings; required wattages shall be as specified below or indicated. Unless otherwise specified or indicated, other general requirements shall be as follows as applicable to the fixtures and lamps involved.

2.2 DRIVERS

A. All drivers, UL listed electronic 25 kHz, energy saving type with no more than 20% harmonic distortion. Protection shall be Class P, sound rating shall be A. Emergency battery packs shall be rated for full lumen output for 90 minutes.

2.3 PHOTO CONTROL FOR LIGHTING

A. Photo control shall be self-contained turn lock type head with three EEI-NEMA twist type blades and receptacle with weatherproof housing, photocell, relay, and lightning arrester for surge protection. Unless indicated the dual voltage type responding between 105 and 277 volts shall be used. Rating of contacts shall be 1800 volt amps, for operating minimum 1000 watt lamp load. Reference types Fisher-Pierce 6690 B, Tork 2007 and American Electric 8090-4F. Receptacle and mounting shall be included.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the fixtures where indicated, but make adjustments using the same numbers of fixtures in accordance with the Architectural reflected ceiling plan where suspended ceiling is used.

B. Where suspended ceilings are involved, coordinate recessed fixture types and trims with actually installed ceiling system, and provide all necessary frames and trim to properly complete each particular installation. Fixtures installed in grid shall be bolted to the grid members that are supported to the structure, fixture shall have two wire supports to the structure on opposite sides.

C. Lighting fixture whips shall be no smaller than #14 AWG with a separate ground in lengths per NEC. The whip shall not be used to extend to additional fixtures. Whips shall be no longer than 8 feet.

D. All fixtures shall be wiped clean and foreign material removed from the housing and lens. All lamps in a fixture shall operate.

END OF SECTION

SECTION 27 0000

500 MHZ CATEGORY 6A CABLING SYSTEM

PART 1 GENERAL

1.1 GENERAL BACKGROUND

A. This document is issued as a request for quote for the supply and installation of a structured telecommunications cabling system for Southaven Elementary School Classroom Expansion.

B. The structured cabling system will support voice, data, and imaging applications within the facility located at 8274 Clairborne Drive, Southaven, MS 38671.

C. This document describes the system requirements to be met in the proposals of the data communications cabling vendors to secure under contract all materials, design, engineering, installation, supervision and training services for the structured cabling system.

1.2 TERMS AND CONDITIONS OF BIDS

A. This is an invitation to submit a bid based on the materials, systems and equipment described in this document.

B. All bids must be submitted in accordance with the specifications and information contained herein, as well as with any addenda, if required, issued by the purchaser.

C. The bid package shall be accompanied by a presale warranty commitment binding the awarded contractor and manufacturer to the customer selected, extended warranty package not less than 20 years in length.

D. It is the intent of the Drawings and Specifications to provide a complete workable data communication cabling system ready for the Owner's use. Any item not specifically shown on the drawings or called for in the Specification, but normally required for a complete system, are to be considered a part of the contract.

E. Consideration other than cost alone will be used in making the determination of the successful contractor. These factors will include financial stability, availability, design support, project management and field supervision.

F. The Manufacturers and Products specified in the document are to be used. No substitutions of components specifically referenced will be allowed, without prior written customer consent after submittal review.

1.3 INSTRUCTIONS TO THE BIDDER

A. The currency used for said bid will be in U. S. Dollars.

B. Prices shall be quoted in U. S. Dollars.

C. Bids shall be valid for 90 days and other factors such as material and labor rate increases during the duration of this project must be taken into account.

D. The Bidder shall consider the nature and amount of work to be done as well as the difficulties involved in its proper execution.

E. No bid will be accepted by any contractor who did not attend the scheduled mandatory site survey.

F. The bid shall include all costs deemed necessary to cover all contingencies essential to the installation of the specified system.
   1. Total cost for installation materials, labor project management, permit fees, sales tax and other miscellaneous items must be listed separately.
   2. A complete materials list, including description, manufacturer, part number, quantity, unit price and total price must also be included.
   3. A statement of estimated labor hours and prevailing hourly labor rates must be included.
   4. All products and materials shall be new, clean, free of defects and free of damage and corrosion. The only exception will be when existing equipment in the school, such as racks, remains a part of the network.
   5. Where discrepancies are found during the bid process, the most stringent requirements must be included in the bid.
   6. Any cost encountered, which is not specifically itemized in the bid, shall not be incurred unless specifically agreed upon, in writing.
   7. No additional compensation will be allowed for extra work incurred on the part of the Contractor due to the bidders failure to notice any existing condition, which may cause the additional labor.
   8. Bid responses shall be concise following the format and numbering of this specification. Items not requiring responses shall be acknowledged by the bidder as being understood.
   9. Bidders must notify the Purchaser as soon as detected any omissions or errors in the specification so corrective addenda may be issued. Such notification must be received by the Purchaser, at least (10) days prior to the date for receipt of bids.
   10. Bids will be accepted at Desoto County School District, 5 East South Street, Hernando, MS 38632 by JANUARY 20, 2017 at 2:00 P.M. Bids received after this time will be returned unopened.
   11. Inquiries and requests for clarifications should be submitted to Lendon Balch, Director of Technology in writing within one (1) week following receipt of these specifications.

1.4 RIGHTS OF THE PURCHASER

A. The Purchaser reserves the right to accept any bid or, at its discretion, reject any or all bids for whatever reason it deems appropriate.

B. The Purchaser reserves the right to purchase ALL or PART of the cabling materials and Hardware needed for the project.

C. Receipt of a bid response does not obligate the Purchaser to pay any expenses incurred by the bidder in preparation of the bid response or obligate the Purchaser in any other respect.

D. The Purchaser reserves the right to modify the specifications contained in the Request for Quote anytime during the bidding period.

E. Only changes issued as an addendum will be binding upon the Purchaser. No verbal instructions or interpretations of requirements shall be accepted.

1.5 SCHEDULE OF EVENTS

A. The schedule below indicates the critical dates that must be satisfied by the Contractor. The Contractor must staff its work crews appropriately to meet the required dates of completion. Installation of a network into a school while in session must sometimes work around the school schedule. Networks cannot be down during state mandated testing. Circumstances such as these will be valid reason for work to halt temporarily for two to four days.

1.6 CONTRACTOR QUALIFICATIONS

A. The Contractor shall at a minimum possess the following qualifications:

B. Be in business a minimum of five (5) years.

C. Contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.

D. Personnel must be knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

E. Must possess current liability insurance certificates and workers compensation coverage.

F. Contractor must be registered with BICSI and have at least one RCDD and RTPM on staff.

G. Contractor must have a service facility within 50 mile radius of Desoto County.

H. The contractor shall have installed a project of this type of cable and of this size.

I. Contractor must be Avaya Certified.

J. Contractor must be Gallagher Certified.

1.7 REQUIRED CONTRACTOR TRAINING

A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:

B. Personnel trained and certified in the design of the Siemon Cabling System®.

C. Personnel trained and certified to install the Siemon Cabling System®.

D. The Designer and Installer shall show proof of current certification of the Siemon Cabling System® via an updated certificate given after attending the CI-301 training course or an on-line re-certification class given every two years.

E. Provide references of the type of installation provide in this specification.

1.8 CONTRACTOR RESPONSIBILITY

A. Contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in this request for proposal.

B. Contractor acknowledges that DeSoto County Schools will rely on contractor's expertise, ability and knowledge of the system being proposed and shall be obligated to exercise the highest of standard care in performing its obligation as defined in the following Scope of Work.

1.9 MANUFACTURER QUALITY & PRODUCT SUBSTITUTIONS

A. All telecommunications connecting hardware and cable must be made by an ISO 9001 Certified Manufacturer and be of single source.

B. All products must meet the technical requirements listed in sections 6-8. Any products not meetings these requirements will not be considered.

1.10 INDUSTRY REQUIREMENTS

A. STANDARDS
1. The following installation, documentation, component and system industry specifications shall be met or exceeded:
2. ANSI/TIA/EIA-568-B.1 and addenda
3. ”Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements”
4. ANSI/TIA/EIA-568-B.2 and addenda
5. ”Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair”
6. ANSI/TIA/EIA-568-B.3 and addenda
7. ”Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling and Components Standard”
8. ANSI/TIA/EIA-569-B and addenda
9. ”Commercial Building Standard for Telecommunications Pathways and Spaces”
10. ANSI/TIA/EIA-606-A and addenda
11. ”Administration Standard for the Telecommunications Infrastructure of Commercial Buildings”
12. ANSI-J-STD-607-A and addenda
13. “Commercial Building Grounding and Bonding Requirements for Telecommunications”
14. ANSI/TIA/EIA-526-7
15. ”Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant”
16. ANSI/TIA/EIA-526-14A
17. ”Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant”
18. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments
19. “Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling”
20. ISO/IEC 11801:2002 Ed2.0 and amendments
21. ”Information technology - Generic cabling for customer premises”
22. CENELEC EN 50173:2000 and amendments
23. ”Information Technology - Generic cabling systems”

1.11 SCOPE OF WORK:

A. Scope of work
1. To install a Category 6A Network in Southaven Elementary School.
2. All Fiber on this project will be 12 strand OM3 and a 12 Strand SM Fiber.
3. Per every 48 ports of switch connection a 1Gbe connection will be made. .
4. All new Fiber Patch cords will be LC to LC.
5. For every 24 port patch panel and between every switch a Horizontal Cable manager will be installed.
6. A new J hook path will be installed.
7. Desoto County has standardized on Brocade Switches and Siemon Cabling. Attached is a Bill of Materials for this project.
8. The Core Switch will be created by interconnecting two ICX6610-48 with additional fan and power included.
9. New fiber jumpers will be required to get the old building up and running on the new core switch.
10. All Closets will have at least one 24 port POE+ switch installed, there must be enough power to run all cameras, telephones and AP’s .
11. All other drops will be controlled using the ICX6450 switches. It is the responsibility of the contractor to make sure that when two 24 ports switches are used in a closet that they are interconnected with a 10 Gig interconnection.
12. The Main Closet will require a new core switch to be installed.
13. All other closet will consist of Enclosed Wall Racks or 2 post floor racks.
14. A new Exacq server is to be installed in the main closet to control a of the new camera’s.

15. All NVR Servers, existing and new, must be upgraded to Enterprise class.
16. A Voicemail server with a minimum of a I5 processor, 500GB hard Drive and 4GB of RAM shall be included in the Bid.
17. One additional server, comparable to the Voicemail server is to also be supplied for the Access Control.
18. Access Control must be integrated with Exacq.
19. Sixty keyfobs should be included with the project.
20. Gallagher is in place with all integrations required if certified by Gallagher must interface to the Gallagher server that is already in school district.

PART 2 PRODUCTS

2.1 HORIZONTAL CABLING - COPPER

A. In addition to meeting the 500 MHz category 6A specifications outlined in ANSI/TIA/EIA-568-B.2-10, the requirements in this section must also be met for all applicable balanced twisted-pair products as listed below.

2.2 OUTLETS

A. All 500 MHz category 6A information outlets designed for termination of 4-pair balanced twisted- pair category 6A copper cable must possess the following characteristics at the minimum:
   1. Exceed category 6 or 6A component compliance through the frequency range of 1 to 250MHz with usable bandwidth to 500MHz
   2. Universal design allows the same outlet to be mounted in flat or angled orientation.
   3. Terminates with an ergonomic and easy to use Z-tool to ensure fast and simple terminations.
   4. Have a lacing module that offers zero-cross termination, which eliminates pair crossing
   5. Have available termination tool included with each box of 20 outlets
   6. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity
   7. Support industry standards for T568A or T568B wiring options on each individual outlet
   8. Allow installation from the front or rear of the faceplate, and allow for the jack to pass through the faceplate without re-termination
   9. Provide color-coded, snap-in icons available for circuit identification
   10. Allow for a minimum of 5 terminations without signal degradation below standards compliance limits
   11. Be constructed of high impact, glass reinforced nylon.
   12. Have, as an option, an outlet, which can be mounted into an IEC 60603-7 compliant opening (keystone)
   13. Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards

2.3 FACEPLATES

A. All faceplates installed, as part of this specification shall have these minimum features listed below:
   1. Be applicable to both fiber and copper applications.
   2. Be available in 1-, 2-, 3-, 4- and 6-port single-gang configurations or 6-, 8- and 12-port double-gang configurations.
   3. Allow modules to be removed from the front of the faceplate.
   4. Allow UTP modules to pass through faceplates even after termination.
   5. Have write on designation labels for circuit identification together with a clear plastic cover.

6. Feature easily removable designation label covers which can be removed without use of tools.
7. Be available in single-gang and double-gang configurations.
8. Have as a minimum the standard colors of black, white, gray, ivory and light ivory.
9. Have stainless steel versions available with designation label option.
10. Have surface mount boxes and standoff rings available for both single and double gang faceplates.
11. Be manufactured using UV resistant, high impact thermoplastic to prevent color fading and provide additional durability.
12. Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards.

2.4 PATCH CORDS

A. All 10G 6A modular equipment cords shall conform to the following minimum performance standards:
1. Be augmented category 6 component compliant out to 250MHz with operational bandwidth to 500MHz
2. Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 500MHz
3. Be backwards compatible with lower performing categories
4. Be equipped with identical modular 8-position plugs on both ends, wired straight through with standards compliant wiring
5. Have a metal plug housing to provide durability and resistance to damage.
6. Have a PCB based plug to enable high levels of performance.
7. Have fixed position front contacts to ensure plug quality and consistent mating with outlets.
8. Have internal rear contacts to maintain cable pair symmetry to the point of termination.
9. Have a boot that features an ultra slim design for high density applications and snag free operation.
10. Use modular plugs, which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 micro-inches minimum of gold plating over nickel contacts
11. Have a dual jack construction for excellent alien crosstalk performance.
12. Be available in standard lengths of 3, 5, 7, 10, 15 and 20 ft.
13. Have optional colored clips to allow field color coding even when cords are already installed. Available in Black, White, Red, Gray, Yellow, Blue, Green and Orange
14. Be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards

2.5 CABLE

A. All 10G 6A cable shall conform to the following minimum performance standards:
1. Have a round lead free cable jacket available in both CMR and CMP options with a nominal cable O.D. of less than or equal to 8.13mm (0.32 in.)
2. Have a construction comprised of 4-pairs of 23AWG solid bare copper conductors
3. Have Trisolator™ technology in conjunction with Internal Longitudinal Striations (ILS) jacket construction to reduce Alien Crosstalk coupling.
4. Be available in 1000’ reels
5. Be available in white, red, gray, yellow, blue and green
6. Provide the following 4-connector guaranteed channel performance:

Frequency (MHz)	Insertion Loss (dB)	NEXT Loss (dB)	PS NEXT Loss (dB)	ACR (dB)	PSACR (dB)	ACRF (dB)	PS ACR-F (dB)	Return Loss (dB)	Propagation Delay (ns)
1.0	2.1	74.3	72.3	72.2	70.2	67.8	64.8	20.0	570
4.0	3.8	65.3	63.3	61.5	59.5	55.7	52.7	23.0	552
10.0	5.9	59.3	57.3	53.4	51.4	47.8	44.8	25.0	545
16.0	7.5	56.2	54.2	48.8	46.8	43.7	40.7	25.0	543
20.0	8.4	54.8	52.8	46.4	44.4	41.7	38.7	25.0	542
31.25	10.5	51.9	49.9	41.4	39.4	37.9	34.9	23.6	540
62.5	15.0	47.4	45.4	32.4	30.4	31.8	28.8	21.5	539
100.0	19.1	44.3	42.3	25.2	23.2	27.8	24.8	20.1	538
200.0	27.6	39.8	37.8	12.2	10.2	21.7	18.7	18.0	537
250.0	31.1	38.3	36.3	7.3	5.3	19.8	16.8	17.3	536
300.0	34.3	37.1	35.1	2.9	0.9	18.2	15.2	16.8	536
350.0	37.2	36.1	34.1	-1.1	-3.1	16.9	13.9	16.3	535
400.0	40.1	35.3	33.3	-4.8	-6.8	15.7	12.7	15.9	535
500.0	45.3	33.8	31.8	-11.4	-13.4	13.8	10.8	15.2	536
625.0*	51.2	32.4	30.4	-18.8	-20.8	11.8	8.8	14.5	535
750.0*	56.7	31.2	29.2	-25.5	-27.5	10.3	7.3	14.0	535

7. Performance for frequencies beyond TIA and ISO requirements are for information only
8. Meet the following electrical specifications:

DC Resistance	<9.38 Ω/100m
DC Resistance Unbalanced	3%
Mutual Capacitance	5.8 nF/100m
Capacitance Unbalanced	<330 pF/100m
Characteristic Impedance (ohms)	1 – 100MHz: 100 ± 15% 100 - 750MHz: 100 ± 22%
NVP	CMP - 67% CMR - 67%
TCL	30-10Log(f/100)dB
Delay Skew (ns)	≤ 45/100m

2.6 BACKBONE CABLING

A. CABLE

1. MULTIMODE OPTICAL FIBER CABLE
   a. All horizontal multimode optical fiber cable must be a minimum of two strands of 50/125µm multimode.
      (1) Have an Aqua colored round lead free cable jacket available in both OFNR and OFNP constructions.
      (2) Shall contain a Rip Cord applied under the cable jacket for easy cable jacket removal
      (3) Shall contain a lightweight Central Strength member located in the middle of the fiber bundles.
      (4) Shall contain both color-coded buffered fibers as well as color-coded buffer tubes.
      (5) Cables shall have length markings in 2 ft. increments
      (6) Fiber will be available in strand counts of 2, 4, 6, 8, 12, 16, 24, 36, 48, 72, 96 and 144.

(7) Shall meet these minimum performance parameters:

Minimum Performance Parameters for Qualified Cables					
Minimum Bandwidth (MHz-km)		Maximum Attenuation (dB/km)		Group Index of Refraction	
850 nm	1300 nm	850 nm	1300 nm	850 nm	1300 nm
Laser - 2000 OFL - 1500	OFL - 500	3.5	1.0	1.483	1.479

(8) Ethernet Applications Supported:

Application	Distance (m)
10GBASE-SX (850 nm)	300
10GBASE-LX4 (1300 nm)	300
1000BASE-SX (850 nm)	900
1000BASE-LX (1300 nm)	600
Fibre Channel 266 (1300 nm)	1,500
ATM 622 (1300 nm)	500
ATM 155 (1300 nm)	2,000
ATM 52 (1300 nm)	3,000
FDDI (Original 1300 nm)	2,000
100BASE-FX (1300 nm)	2,000

(9) Physical Characteristics:

Core Size (Microns)	Cladding Size (Microns)	Coating Size (Microns)	Buffer Size (Microns)	Core Cladding Concentricity (Microns)
50 ± 3	125 ± 2	245 ± 10	900 ± 50	≤3.0

2.7 SINGLEMODE OPTICAL FIBER CABLE

A. Singlemode optical fiber cable shall be used for 1st and 2nd Level Backbone applications only.
   1. Have a Yellow colored round lead free cable jacket available in both OFNR and OFNP constructions.
   2. Shall contain a Rip Cord applied under the cable jacket for easy cable jacket removal
   3. Shall contain a lightweight Central Strength member located in the middle of the fiber bundles.
   4. Shall contain both color-coded buffered fibers as well as color-coded buffer tubes.
   5. Cables shall have length markings in 2 ft. increments
   6. Fiber will be available in strand counts of 2, 4, 6, 8, 12, 16, 24, 36, 48, 72, 96 and 144.
   7. Shall meet these minimum performance parameters:

Minimum Performance Parameters for Qualified Cables						
Cable Type	Maximum Attenuation (dB/km)		Zero dispersion		Index of Refraction	
	1310 nm	1550 nm	Wavelength (nm)	Slope (nm-km)	1310 nm	1550 nm
Indoor	0.50	0.50	1300-1324	<0.093	1.467	1.468

8. Ethernet Applications Supported

Application	Distance (m)
10GBASE-L (1310 nm)	8,000
10GBASE-E (1550 nm)	30,000
10G Fibre Channel (Serial-1310 nm)	10,000
10G Fibre Channel (WDM-1310 nm)	10,000
1000BASE-LX (1300 nm)	5,000
Fibre Channel 266/1062 (1300 nm)	10,000
ATM 52/155/622 (1300 nm)	15,000

9. Physical Characteristics:

Mode and Fiber Type	Core Size (Microns)	Cladding Size (Microns)	Coating Size (Microns)	Buffer Size (Microns)	Core Cladding Concentricity (Microns)
Singlemode	8.3 ± 1.0	125 ± 1.0	245 ± 10	900 ± 50	≤ 0.8

2.8 BACKBONE CABLING

A. Cables allowed for use in the backbone include: RG-6 or RG-11 Coax, 50/125□m □m multimode optical fiber, and singlemode optical fiber cables. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.

2.9 INTERBUILDING CABLING

A. When a distribution system encompasses more than one building, the components that provide the link between buildings constitute the Interbuilding Backbone Subsystem. This subsystem includes the backbone transmission media, associated connecting hardware terminating this media, and electrical protection devices to mitigate harmful voltages when the media is exposed to lightning and/or high voltage power surges that pass through the building cable. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building.

2.10 EQUIPMENT ROOMS

A. PATCH PANELS
   1. All 10G 6A-termination panels shall facilitate cross-connection and inter-connection using modular patch cords and shall conform to EIA standard, 19-inch relay rack mounting requirements.
      a. Be made of lightweight, high strength steel with durable black finish in 24 & 48 port 1U configurations
      b. Panel outlets feature a patented angled IDC contact pattern to exploit the widest outlet cross-section to minimize alien crosstalk.
      c. Have a quick release lever that allows individual outlets to be easily removed even in tight installations.
      d. Have port identification numbers on the front of the panel

e. Accommodate both 24 & 48 ports for each rack mount space (1RMS = 44.5 mm [1.75 in.])
f. Come equipped with integrated rear wire management system
g. Be provided with high visibility snap-on magnifying label holders that contain paper labels or Z-MAX icons for port identification.

2.11 FIBER ENCLOSURES

A. All interconnect centers, panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
1. Be available in black and constructed of 0.08 thickness aluminum alloy with 18-gauge steel cover.
2. Feature compact 4 RMS (178.0mm [7.00 in.]) design
3. Use single-finger accessible fiber adapter plates incorporating FC, LC, MT-RJ, SC, SC/ST and ST fiber adapters with blank plates available for support of future growth.
4. Support the following fiber capacities and interfaces using fiber adapter plates:

Adapter Types	Capacity
FC, SC, SC/ST, ST	72
FC, SC, SC/ST, ST	96
LC, MT-RJ, SC, ST	144
LC, MT-RJ	192
LC, MT-RJ	288

5. Incorporate dual-level fiber managers to effectively store fiber cable slack in both the front and rear of the enclosure.
6. Have integrated key-lockable front and rear transparent doors with single-finger latches and spring release hinges for removal.
7. Accommodate up to six 24-port fusion or 12-port mechanical stackable splice trays.
8. Have a sliding tray that can slide out the front and rear of the enclosure and be secured at multiple working positions as well as be fully removable for increased access.
9. Have cable access points for fiber jumpers entering and exiting the unit with rotating grommets to facilitate cable loading and to minimize micro bending stress.
10. Have anchor points for securing fiber cable(s) entering the unit.
11. Have labeling that can be viewed with doors open or closed and meets or exceeds ANSI/TIA/EIA-606-A requirements and also be laser printable.
12. Be able to mount both 19-inch and 23-inch rack/cabinets.
13. Must be certified by Underwriters Laboratories to UL 1863 United States Standards and C22.2 Canadian Telecommunications Standards.

2.12 RACKS

A. For rack-mounted installations in a telecommunications room the installer shall use a 19 or 23- inch equipment rack as outlined below:
1. Have 116.8 mm (4.6 in) by 152 mm (6 in) vertical cable channels as side rails in 2.1 m (7 ft) height.
2. Include vertical cable managers mounted on the front of the channels with hinged covers that can handle large quantities of cables and patch cords. Cable managers must retain cables even when covers are removed. Covers are modular in design, which eliminates the need to remove full-length covers for each patch cord change.
3. Have available additional vertical cable manager segments for mounting to the back of the Rack to provide additional cable management.
4. Have channels capable of utilizing and re-locating ten high capacity, reusable hook and loop cable managers available in bags of ten.
5. Have cable access holes on side rails, which allow cables to be routed between adjacent racks.

6. Have standard 19-inch CEA-310-E mounting holes having a full 45 RMS on front and back of rails.
7. Have ladder channel, which acts as a top bracket to easily nest a standard 304.8 mm (12 in) ladder tray. The channel must have carriage bolt holes for attaching to the ladder system.
8. Have available an optional rack top cable tray which manages cable bundles routed above the rack, and eliminates the need for installing a ladder rack for routing cables. The tray is mounted without the need of tools or hardware and includes up to three (3) separate cable paths featuring removable quarter-turn hook and loop cable managers.
9. Be available in two versions, either aluminum or steel with a black finish and utilize black grommets for unused cable openings.
10. Have the mounting option of two additional vertical cable management channels 152 mm (6 in) x 2.1 m (7 ft) and 76 mm (3 in) x 2.1 m (7 ft) which can be located between racks. The channel shall include cable retainers, which can be hinged left or right and be located in any position along the channel.
11. Have floor mounting holes and a ground lug for 0-6 gauge ground cable provided.
12. Have optional 10-outlet (4 ft) power strip for mounting onto the rack.

2.13 CABINET

A. For cabinet enclosure installations in a telecommunications room or data center the installer shall have these minimum features listed below:
   1. Have overall dimensions of 1000mm (40”) deep by 760mm (30”) wide and 2130mm (84”) tall.
   2. Be available with fully perforated front and rear doors to maximize air flow efficiency.
   3. Both front and rear doors must have the ability to open from the left and right without the need for any field modifications or tools.
   4. Cabinet to be designed with structural corner posts recessed back from both front/rear and sides.
   5. Have standard CEA-310E mounting holes having a full 45 RMS.
   6. Both front and rear doors available in split door option with same left and right opening feature.
   7. When “bayed” together, the cabinets shall create a 7” space between cabinets that can be used for the installation of a variety of vertical cable management and vertical (Zero U) patch panels.
   8. Be constructed of steel with a total static load capacity of 1000kg (2200lbs).
   9. Have a top lid that offers multiple cable entry points as well as features for the installation of a ventilation fans, blank panels and cable entry brush guards.
   10. Have an open access floor enabling maximum airflow as well as cable routing.
   11. Offer a full variety of internal cable management accessories.
   12. Offer a full variety of integrated vertical patch panels that offer solutions for UTP, F/UTP, Fiber and Power distribution.

2.14 HORIZONTAL CABLING

A. The Horizontal Subsystem is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the telecommunications room. It consists of the telecommunications outlet/connector, the horizontal cables, optional consolidation point, and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each floor of a building should be served by its own Horizontal Subsystem.

2.15 TELECOMMUNICATIONS ROOM

A. The Telecommunications Room is generally considered to be a floor serving facility. The Horizontal Cross-connect links the Horizontal Subsystem and the Backbone Subsystem together.

B. The Horizontal Cross-connect shall consist of rack or wall mounted wiring blocks or panels for termination of copper cables or rack or wall mount interconnect centers or fiber management panels/trays for the termination of optical fibers.

C. Cross-connect spaces include the labeling of hardware for providing circuit identification and patch cords or cross-connect wire used for creating circuit connections at the cross-connect.

D. The telecommunications room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.

E. Separation from sources of EMI shall be in accordance with ANSI/TIA/EIA-569-B and local codes.

F. Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

G. The telecommunications room shall be dedicated to the telecommunications function. Access to telecommunications rooms shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the telecommunications systems or be used for building maintenance services.

H. Lighting in the telecommunications room should be a minimum of 500 lx (50 foot candles) at the lowest point of termination. Light switch should be easily accessible when entering the room.

I. A minimum of two dedicated duplex or two dedicated simplex electrical outlet, each on a separate circuit, should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

2.16 EQUIPMENT ROOM

A. The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications room and the transmission media required to terminate this equipment on distribution hardware.

B. The equipment room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.

C. Separation from sources of EMI shall be as specified in the Telecommunication Room section of this specification.

D. Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

E. The equipment room shall not be shared with building services that may interfere with the telecommunications.

F. Lighting in the equipment room should be a minimum of 500 lx (50 foot candles) at the lowest point of termination.

G. A minimum of two dedicated duplex or two dedicated simplex electrical outlet each on a separate circuit should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

2.17 ENTRANCE FACILITY

A. The entrance facility shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.

B. Separation from sources of EMI shall be as specified ANSI/TIA/EIA-569-B.

C. Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

D. The entrance facility shall not be shared with building services that may interfere with the telecommunications systems or be used for custodial services.

E. The entrance facility shall be located in a dry area not subject to flooding and should be as close as possible to the electrical service room in order to reduce the length of the bonding conductor to electrical grounding system.

F. Lighting in the entrance facility should be a minimum of 500 lx (50 foot candles) at the lowest point of termination.

G. A minimum of two dedicated duplex or two dedicated simplex electrical outlet each on a separate circuit should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

PART 3 EXECUTION

3.1 INSTALLATION

A. SITE SURVEY
   1. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

3.2 CABLE PATHWAYS

A. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.

B. Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations.

C. Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.

D. The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.

E. Pathways shall not be located in elevator shafts.

3.3 INTRABUILDING CABLE ROUTING

A. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications rooms and the main or intermediate cross-connect in a long single story building like a school or factory.

B. Unless otherwise recommended by the manufacturer, all fiber cables will be run in innerduct.

C. Fibers will be terminated in the telecommunications rooms using SC connectors in rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.

D. Adequate riser sleeve/slot space shall be available with the ability to ingress the area at a later date in all telecommunications rooms, such that no drilling of additional sleeves/slots is necessary.

E. The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each telecommunications room. An intermediate cross-connect may be present between the main cross-connect and the horizontal cross-connect. This is known as a hierarchical star topology.

F. At least one RG-6 or RG-11 Coax should be run for each Intrabuilding backbone segment.

G. Optical fiber should be run for any backbone segment. Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.

3.4 HORIZONTAL CABLE ROUTING

A. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.

B. The combined length of jumpers, or patch cords and equipment cables in the telecommunications room and the work area should not exceed 10 m (33 ft) unless used in conjunction with a multi-user telecommunications outlet.

C. Two horizontal cables shall be routed to each work area. At least one horizontal cable connected to an information outlet shall be 4-pair, 100 Ω balanced twisted-pair.

D. It is recommended that a minimum horizontal cable distance of 15 m (49 ft.) shall be maintained between the telecommunications room and the work area.

E. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.

F. In open ceiling cabling, cable supports shall be provided by means that is structurally independent of the suspended ceiling, its framework, or supports. These supports shall be spaced no more than 1.5 m (5 ft) apart. NOTE: Cable tie-downs should maintain a minimum distance of 0.6 m (2 ft) apart when within 5 m (16 ft) of the termination point.

G. UTP ONLY: Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is less than 3kVA, shall be installed with a minimum clearance of 50 mm (2 in).

H. UTP ONLY: Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is more than 3kVA but less than 6kVA, shall be installed with a minimum clearance of 1.5 m (5 ft).

I. UTP ONLY: Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is more than 6kVA, shall be installed with a minimum clearance of 3 m (10 ft).

J. No telecommunications cross-connects shall be physically located within 6 m (20 ft) of electrical distribution panels, step down devices, or transformers, which carry voltages in excess of 480 Vrms.

K. For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.

L. The Contractor shall observe the bending radius and pulling strength requirements of the 4 pair balanced twisted-pair and fiber optic cable during handling and installation.

M. Each run of balanced twisted-pair cable between horizontal portion of the cross-connect in the telecommunication closet and the information outlet shall not contain splices.

N. In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.

O. Continuous conduit runs installed by the contractor should not exceed 30.5 m (100 ft) or contain more than two (2) 90 degree bends without utilizing appropriately sized pull boxes.

P. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.

Q. The number of horizontal cables placed in a cable support or pathway shall be limited to a number of cables that will not cause a geometric shape of the cables. Under no circumstances should cables in the horizontal pathway be bundled. This is to minimize “alien” cross talk.

R. Maximum conduit pathway capacity shall not exceed a 40% fill. However, perimeter and furniture fill is limited to 60% fill for move and changes.

S. Horizontal distribution cables shall not be exposed in the work area or other locations with public access.

3.5 WORK AREA TERMINATION

A. All balanced twisted-pair cables wired to the telecommunications outlet/connector, shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.

B. The telecommunications outlet/connector shall be securely mounted at planned locations.

C. The height of the telecommunications faceplates shall be to applicable codes and regulations.

3.6 PULLING TENSION

A. The maximum cable pulling tensions shall not exceed 25lbf (max).

3.7 BEND RADIUS

A. The maximum cable bend radii shall not exceed manufacturer’s specifications.

B. In spaces with balanced twisted-pair cable terminations, the maximum bend radius for the 4 pair cable shall not exceed four times the outside diameter of the cable. This shall be done unless this violates manufacturer specifications.

C. During the actual installation, bend radius on 4 pair cable shall not exceed eight times the outside diameter of the cable. This shall be done unless this violates manufacturer specifications.

3.8 SLACK

A. In the work area, a minimum of 300 mm (12 in) should be left for balanced twisted-pair cables, while 1 m (3 ft) be left for fiber cables.

B. In telecommunications rooms a minimum of 3 m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types.

3.9 CABLE TIE WRAPS

A. Hook and loop cable managers shall be used at appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath. NOTE: Tie wraps shall not be used at all.

B. Hook and loop cable managers should be used in the closet where reconfiguration of cables and terminations may be frequent.
1. Siemon Company VCM Series Recommended

3.10 GROUNDING

A. All grounding / earthing and bonding shall be done to applicable codes and regulations.

3.11 FIRE PROTECTION

A. Properly installed firestop systems shall be installed to prevent or retard the spread of fire, smoke, water, and gases through the building. This requirement applies to openings designed for telecommunications use that may or may not be penetrated by cables, wires, or raceways.

B. Fire stops shall be done to applicable code.

3.12 WORKMANSHIP

A. All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.

B. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed.

C. Workers must clean any debris and trash at the close of each workday.

3.13 TESTING

A. Testing of all newly installed cable channels shall be performed prior to system cutover.

3.14 COPPER TESTING

A. All 500 MHz category 6A field-testing shall be performed with an approved level 111e balanced twisted-pair field test device.

B. All installed 500 MHz category 6A channels shall perform equal to or better than the minimum requirements as specified by the table below:

Parameter	100 MHZ	250 MHz	500 MHz
Insertion Loss	20.0 dB	32.6 dB	54.1 dB
NEXT Loss	46.4 dB	39.6 dB	26.2 dB
PS NEXT	45.1 dB	38.2 dB	23.1 dB
ACR	26.4 dB	7.0 dB	-37.4 dB

PS ACR	22.6 dB	4.5 dB	-40.5 dB
ACR-F	30.3 dB	22.3 dB	7.3 dB
PS ACR-F	29.3 dB	21.3 dB	4.3 dB
Return Loss	16.0 dB	12.0 dB	8.0 dB
Prop Delay	528 ns	526 ns	526 ns
Delay Skew	40 ns	40 ns	40 ns

C. Warranty performance claims are based on worst case testing and channel configurations. Typical channel performance may be significantly higher. Independent test reports are now available.
   1. Category 3, balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), insertion loss, length and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.
   2. All balanced twisted-pair backbone cables exceeding 90 m (295 ft) or 100 m (328 ft) shall be 100% tested for continuity if applications assurance is not required.
   3. 500 MHz Category 6A balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.

3.15 TEST EQUIPMENT CRITERIA

A. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.

B. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters

C. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

3.16 FIBER OPTIC TESTING

A. BACKBONE FIBER TESTING
   1. Fiber horizontal cables shall be 100% tested for insertion loss and length.
   2. Insertion loss shall be tested at 850 nm and 1300 nm for 50/125□m and 62.5/125□m multimodes cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
   3. Insertion loss shall be tested at 1310 and 1550 for singlemode cabling in at least one direction using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
   4. Length shall be recorded using an OTDR, optical length test measurement device or sequential cable measurement markings.
   5. The backbone link performance guarantees are as follows:
      a. Administration & Documentation
         (1) Labeling
            (a) Horizontal and backbone cables shall be labeled at each end. The cable or its label shall be marked with its identifier.
            (b) A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
            (c) Each port in the faceplate shall be labeled with its identifier.

(d) A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
(e) Each port on the connecting hardware shall be labeled with its identifier.
(f) Identifier shall be explained on separate sheet called “Additional bid specs for Southaven Elementary School Classroom Expansion”.

3.17 DRAWINGS

A. As-built drawings shall be supplied by the contractor showing the locations of and identifiers for all:
1. Horizontal cable routing and terminations
2. Telecommunications outlets/connectors
3. Backbone cable routing and terminations

3.18 RECORDS AND REPORTS

A. All records shall be created by the installation contractor and turned over at the completion of work

B. The format shall be computer based and both soft copies and hard copies shall be part of the As-built package. The minimum requirements include:
1. Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
2. Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the cable identifier attached to it.
3. Test documentation on all cable types shall be included as part of the As-built package.

C. All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:
1. Cable Reports
2. Cross-connect Reports
3. Connecting Hardware Reports

3.19 WARRANTY

A. Either a basic link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 500 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

3.20 SYSTEM WARRANTY

A. A twenty (20) year warranty available for the 500 MHz category 6A structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof.

B. Additional features of the warranty shall include:
1. 10G 6A channel specifications on all parameters across the entire frequency range of 1-500 MHz as noted below:

Frequency (MHz)	*Insertion Loss (dB)*	*Return Loss (dB)*	*NEXT (dB)*	*PS NEXT (dB)*	*ACR-N (dB)*	*PS ACR-N (dB)*	*ACR-F (dB)*	*PS ACR-F (dB)*	*PS ANEXT (dB)*	*PS AACR-F (dB)*	*Prop Delay (ns)*	*Delay Skew (ns)*
1	*2.2*	*22.0*	*65.0*	*62.0*	*62.8*	*59.8*	*65.0*	*62.0*	*67.0*	*67.0*	*580*	*40.0*
4	*4.0*	*22.0*	*65.0*	*62.0*	*61.0*	*58.0*	*56.2*	*55.2*	*67.0*	*65.0*	*562*	40.0
10	*6.3*	*22.0*	*63.1*	*61.5*	*56.8*	*55.2*	*48.3*	*47.3*	*67.0*	*57.0*	*555*	40.0
20	*8.9*	*20.5*	*58.1*	*56.5*	*49.2*	*47.6*	*42.2*	*41.2*	*67.0*	*51.0*	*552*	40.0
62.5	*15.9*	*17.0*	*49.9*	*48.1*	*34.0*	*32.2*	*32.3*	*31.3*	*62.0*	*41.1*	*549*	40.0
100	*20.3*	*15.0*	*46.4*	*44.6*	*26.1*	*24.3*	*28.3*	*27.3*	*60.0*	*37.0*	*548*	40.0
200	*29.3*	*12.0*	*38.3*	*39.4*	*9.0*	*10.1*	*22.2*	*21.2*	*55.5*	*31.0*	*547*	40.0
250	*33.0*	*11.0*	*36.6*	*37.7*	*3.7*	*4.7*	*20.3*	*19.3*	*54.0*	*29.0*	*546*	40.0
300	*36.3*	*11.0*	*31.7*	*28.8*	*-4.6*	*-7.6*	*18.7*	*17.7*	*52.8*	*27.5*	*546*	40.0
400	*42.5*	*11.0*	*28.7*	*26.6*	*-13.7*	*-15.9*	*16.2*	*15.2*	*51.0*	*25.0*	*546*	40.0
500	*48.0*	*11.0*	*26.1*	*24.8*	*-21.9*	*-23.1*	*14.3*	*13.3*	*49.5*	*23.0*	*546*	40.0
TIA Margin[1] (1-250 MHz)	*2.75 %*	*3.0*	*3.5*	*4.5*	*4.0*	*5.0*	*5.0*	*7.0*	*0*	*0*	*0*	10.0
ISO Margin[2] (1-250 MHz)	*2.75 %*	*3.0*	*3.5*	*4.5*	*4.0*	*5.0*	*3.0*	*5.0*	*0*	*0*	*0*	10.0
TIA Margin[1] (1-500 MHz)	*2.75 %*	*3.0*	*0*	*0*	*0*	*0*	*5.0*	*7.0*	*0*	*0*	*0*	10.0
ISO Margin[2] (1-500 MHz)	*2.75 %*	*3.0*	*0*	*0*	*0*	*0*	*3.0*	*5.0*	*0*	*0*	*0*	10.0

2. Performance claims based on worst case testing and channel configurations

3.21 PRODUCT WARRANTY

A. The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its product. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.

3.22 APPLICATIONS SUPPORTED

A. Existing and future applications supported for a channel model warranty include those approved by the Institute of Electronic and Electrical Engineers (IEEE), the Asynchronous Transfer Mode (ATM) Forum, the American National Standards Institute (ANSI) or the International Organization of Standards (ISO) that specify compatibility with the cabling referenced herein.

B. Bill of Material

Career Tech Center West			
Manufacturer	Product	Description	Quantity
Siemon	9C6P4-A5-02-R1A	Augmented Cat6A Plenum	
Siemon	Z6AS-PNL-24K	24Port Patch Panel	
Siemon	Z6A-02	10G Module	
Siemon	10GMX-FPS02-02	2 Port Faceplate	
Siemon	10GMXFPS01-02	Single Port Faceplate	
Siemon	BP6A-03-06	3' Patch Cords	
Siemon	BP6A-10-06	10' Patch Cords	
Siemon	RS3-RWM-2	2U Horizontal Organizer	
Siemon	RS3-07	Floor Rack	
Siemon	FC1M-LC-5L-B12	LC Laser Optimized Termination	
Siemon	FC1M-LC-SM-B06	LC Singlemode Termination	
Siemon	FCP-DWR	Fiber Drawer	
Siemon	RIC3-72-01	Core Enclosure	
Siemon	RIC-F-LC12-01	LC Multimode Adapter Plate	
Siemon	RIC-F-LCU12-01	LC Singlemode Adapter Plate	
Siemon	FJ2-LCLC5V-03AQ	Fiber Jumpers	
Siemon	9BC5P012G-T312A	12 Armored Strand OM3 In/Out Fiber	
APC	SMT2200RM2U	Closet UPS	
APC	SUA5000R5TXFMR	Server Room	
Aruba	AP305	Aruba Access Point	
Aruba	AP-220-MHT-C2	Mounting Kit	
Brocade	ICX-6610-48	48 port 6610 Switch	
Brocade	RPS15-E	6610 Redundant PWR	
Brocade	ICX6610-FAN-E	6610 Fan System	
Brocade	ICX 6450-24	6450 24 port Switch	
Brocade	ICX 6450-24P	6450 24 port POE Switch	
Brocade	ICX 6450-48	6450 48 port Switch	
Brocade	10G-SFPP-TWX-0101	Direct Attach Cable	

Brocade	ICX6610-SVL-RMT-1	ESSENTIAL REMOTE SUPPORT, ICX 6610 24P & 48P Required for 6610	
Brocade	E1MG-SX-OM	1G SFP Module	
Axis	5502-781 w/0511-001	P3384 w/Drop Ceiling Ring	
Axis	0637-001	P1428-E	
Exacq	EVIP-01	Camera Lic	
Caddy	CAT3224	Slam on Jhooks	
	RG6	Cable	
	rg11		
	Outside Cat6 for Phone		
Gallagher	C201311	Command Center Software	
Gallagher	2A8943	Door Lic	
Gallagher	2A8067	Workstation	
Gallagher	C300100	Controller 6000	
Gallagher	C300181	8 Reader Module	
Gallagher	C300410	T11 Reader Mifare	
Gallagher	C41006	Encoder Unit	
Gallagher	C196300	Keyfob	
Gallagher		Access Control Cable Plenum	
Gallagher	Sever	SERVERS	
		Labor	
		MISC	

C. Should any of the item numbers on the above chart have a more current replacement by the same manufacturer, it should be noted in the bid delivered to DeSoto County Schools.

END OF SECTION

SECTION 27 2200

INTERACTIVE BOARD AND PROJECTOR SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. The Contractor shall deliver, erect, connect, and furnish all Material, Appliances, and furnishings as detailed herein.

B. The Contractor shall complete assembly of all equipment in the System and perform all necessary wiring in order to effect complete interconnection of the components in the system.

C. The Contractor shall provide all incidental material, appliances, Tools, etc., required to complete the sound reinforcement system enumerated herein.

D. The Contractor shall also perform all tests and calibrations necessary in order to show that the installed system is in proper and complete working order as specified herein.

E. The Contractor shall provide a complete training program for all teachers.

1.2 INTERACTIVE BOARD SYSTEM

A. Interactive Board Specifications:
1. Must have a tracking rate of 200 inches per second with an output rate of 120 coordinate pairs per second.
2. The pointing device must be a cordless Battery-free pen incorporating tip switch and side switch for full mouse functionality.
3. Must use a passive electromagnetic technology for digitizing
4. Must be capable of either an RS232 interface to host at up to 38.4kbs or a USB 1.5 interface.
5. Screen surface must be made of a low glare melamine
6. Power requirements 6 Volt 0.5 Amp
7. The interactive board must be capable of a resolution 12800 x 9600
8. The Overall dimensions of the interactive board 67" x 49", with an active dimension are of 64"x46" i.e. and active area diagonal of 78".
9. The warranty for the board must be a 3 year limited equipment warranty, plus a 5 year surface warranty.

1.3 INTERACTIVE BOARD FRAME

A. The frame must accommodate either 64" or 78" Interactive Boards. With a projector mount aluminum arm that extends a minimum of 50" from the board.

B. An integrated “power management’ system that will support the Interactive Board, Projector and Speaker system.

C. A cable kit containing connectivity box with inputs for 2 x PC inputs VGA & Audio RCA), S-video and composite video, plus Auxiliary audio RCA inputs. Box also has VGA switch for PC inputs and volume control for audio output cable. Box is mounted to the wall and can be placed on either side of the system.

D. The warranty for the frame and cables must be a 3 year limited equipment warranty for frame and 12 months limited equipment warranty for cables and power supply units

1.4 INTERACTIVE BOARD PROJECTOR

A. The projector must produce a screen size of 60" ~ 80" from a maximum throw distance of 50" via fixed super short focus lens.
   1. The projector display type must be a True XGA (1024 * 768) type.
   2. The display technology should be an LCD, 0.63" TFT p-Si x 3 with Micro Lens.
   3. The projector brightness should consist of 1500 ANSI lumens in Normal mode and 2000 ANSI lumens high mode.
   4. The lamp life expectation should average 3000 hrs (normal mode) and 1500 hrs (high mode)
   5. The aspect ratio should be 4:3 native with support for 16:9 and a contrast ratio: 450:1.
   6. The projector color systems should be compliant to NTSC / NTSC4.43 / PAL / SECAM / PAL-M/N. With an HDTV compatibility: 480i, 480p, 575i, 575p, 720p, 1035i and 1080i.
   7. The projector must have computer compatibility with UXGA / WXGA / SXGA / XGA / SVGA / VGA and MAC.
   8. The projector should have 2 x Composite D-SUB15, first for PC input, 2nd for PC input or monitor output, RCA for Composite video input, Mini-DIN 4-pin for S-video input, RCA audio input pair, Mini-jack (stereo) for PC input, Mini-jack (stereo) for audio output (variable), RS232C service and Control Mini DIN 8-pin USB type B.
   9. Power consumption of 230W normal, 275W high, 9W standby
   10. Security features to include Remote-only operation, pin-code lock, and sonic alarm (100dB), user logo feature (with lock)
   11. A ‘Lamp save’ feature to reduce risk of lamp failing in the event of interrupted power supply.
   12. The projector should carry a three year swap out limited equipment warranty; with a 90 day warranty on lamp.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 27 5113

INTERCOM SYSTEM EXPANSION

PART 1 GENERAL

1.1 GENERAL NOTES

A. Expand the existing intercom system to the new classroom addition.

B. Furnish and install all materials, labor, equipment, permits, etc., to provide communications facilities as described herein and illustrated on the Drawings for a complete operating system.

C. All materials, unless otherwise specified, shall be new, free from any defects, and of the best quality of their respective kinds. All like materials used shall be of the same manufacture, model, and quality, unless otherwise specified.

D. All manufactured articles, material, and equipment shall be applied, installed connected, erected, used, cleaned, adjusted, and conditioned as recommended by the manufacturers, or as indicated in their published literature, unless specifically herein specified to the contrary.

E. All work shall be performed by Contractor and workmen with five years experience with Classroom Intercom Systems and specified products. Execute in a neat and workmanlike manner providing a thorough and complete installation. Work shall be properly protected during construction, including the shielding of soft or fragile materials. At completion, the installation shall be thoroughly cleaned and all tools,, equipment, obstructions, or debris present as a result of this portion of work shall be removed from the premises.

F. Manufacturer's names are listed herein to establish a standard.

G. Contractor shall coordinate his work with the Owner and other trades

1.2 CODE COMPLIANCE

A. All work will conform with the National Electric Code and applicable local ordinances.

1.3 RACEWAYS AND CABLES

A. All 125 volt electrical conductors shall be installed in galvanized electrical metallic tubing with compression type fittings and couplings, minimum ¾ " size conduit. (Furnished under Division 16 Contractor).

B. All low voltage wires and cables concealed in walls shall be run in EMT conduit from flush outlet boxes to above accessible ceilings. Provide conduit where cables penetrate fire walls above ceilings. (Furnished under Division 16 Contractor).

C. All EMT entering boxes shall be served with insulating throat connectors and locknuts. (Furnished under Division 16 Contractor).

D. No raceway shall be located in proximity of hot water lines or excessive heat.

E. Where raceways cannot be run concealed in walls, use Wiremold Series surface raceway complete with all fittings, box extension rings, and required accessories. Coordinate routing of surface raceways with the Owner. (Furnished under Division 16 Contractor).

1.4 HANGERS AND SUPPORTS

A. J-hooks shall be installed by division 16 contractor

B. No perforated straps or tie wires permitted for supporting raceways.

C. Use caddy wire support systems for the installation of wire drop to Ceiling Speakers, Call Buttons, Etc in Classrooms, Hallways, Offices, Etc. Tiewrapes for supporting low voltage cables run concealed above ceilings will not be permitted. Do not run cables loose on ceiling tiles. Support from structure above. Group cables in bundles as per NEC or Local Codes.

D. Tie mounts, plates, and anchors shall be used.

1.5 GROUNDING

A. Ground all electrical apparatus in accordance with the National Electric Code.

1.6 QUALITY ASSURANCE

A. Manufactures: Firms regularly engaged in manufacture of integrated communication systems and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. Contractor’s Qualifications: The Contractor shall show proof that they have had a Mississippi State Contractor’s License for five years under the current name as the contractor is doing business as. The Contractor shall provide proof of at least five years of successful installation experience with projects this size utilizing integrated communications systems and equipment similar to that required for this project.

C. The Contractor shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The Contractor shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

D. The Contractor shall be an established Communications and Electronics Contractor that has and currently maintains a locally operated business for at least five years within twenty miles of Desoto County. The Contractor shall be a duly authorized distributor all of the equipment supplied with full manufacturer's warranty privileges in Desoto County. The bidding contractor shall be responsibly for the installation and service of classroom Intercom System.

E. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

1.7 SERVICE AND MAINTENANCE

A. The Contractor shall provide a one year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner during normal hours. The warranty period shall begin on the date of acceptance by the Owner or the first uses of system which ever is first.

B. The Contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

C. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

1.8 SOLE SOURCE RESPONSIBILITY :

Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and experience in the industry. The Contractor shall have attended the manufacturer's installation and service school and upon request must show proof of attending such a school.

PART 2 PRODUCTS

2.1 CENTRAL CONTROL UNIT ADDITIONS

A. The current Central Control Unit is a Telecor T2 system, the existing head equipment with all existing classroom will be re-used as its current status. The contractor will be responsible for adding the following equipment to make the expansion of the Telecor system meet requirement for the new classroom additions.

1. Provide station cards, master card, and terminal blocks as required for Direct two-way "amplified voice" communication between all locations equipped with Control Consoles and any location equipped with a speaker.
2. Provide all system functions as per the current system use to new additional classroom building. This is to include Time and Bell schedules, Zoning of building all-call, Independent call room zoning, call identification of class room with call switches or master intercom telephones.
3. Provide (Qty 1) Telecor PSU-2 B-TCS power supply, This unit shall provide Ethernet port for time correction of internal clock with in intercom system.

2.2 UNIT

A. Provide, unit shall be a Telecor Model MCC-300, furnish and install quantity as shown on drawings. Each console shall also be provided with ST8/6 wall plate.

B. Ceiling mounted speakers, Provide 2x2 layin ceiling speakers at each location as shown on the drawings, The 2 x 2 assembly shall directly replace a 2 x 2 ceiling tile. Each speaker assembly shall include a factory-mounted driver mounted to a sub-plate with fine perforation white steel grille and restraint tabs for code compliance. Speaker shall be 8-inch speaker with 25v line matching transformer. The transformer shall have wattage tap of .25, 0.5,1, 2, 5 watt taps for 25v/70v line. Tap each classroom speaker at 0.5 watts @ 25v.

2.3 HORN TYPE LOUDSPEAKERS

A. Where horn type loudspeakers are called for, they shall be Soundolier AP15T, or approved equal.

2.4 CALL SWITCHES

A. Call Switches shall be a Telecor CS-1PT, or approved equal. The switch shall be a momentary action, push-button switch mounted on a 1 gang brushed stainless steel plate suitable for flush or surface mounting on a standard single gang

backbox, with 3-9/32" mounting centers. The stainless steel plate shall be inscribed "PUSH TO CALL". Call switch's shall be supplied and installed at each speaker location as indicated on the plans.

PART 3 EXECUTION

3.1 GENERAL WIRING REQUIREMENTS SHALL BE AS FOLLOWS:

A. Wiring for Classrooms, Hallway Speakers and Call Buttons shall be West Penn 25357 or 357, West Penn 25291 or West Penn 452. or as recommend by Intercom manufacture. Each classroom or hallway speaker zone should have homeruns back to Bix or 66 punch blocks in IDF terminal closets or main equipment rack.

B. For Mass cable conductors use Muilti-pair cable in 25, 50 or 100 pair cable counts. Cable shall be shielded multi-pair cable with overall foil or clad shielding. Each muilti-pair cable should have homeruns back to Bix or 66 punch blocks in MDF, IDF terminal closets or main equipment rack. Each cable type shall be suited for installation underground as need or plenum rated for above ceiling locations. Manufacture, General cable, Essex, Comtran. Or as recommend by Intercom manufacture.

C. Administrative Consoles cable , Provide Cat5e cable as recommend by Intercom manufacture. Cable type shall be suited for installation underground as needed or plenum rated for above ceiling locations. If muilti- pair cable is required for distribution of intercom consoles provide separate muilti- pair cable addition to the muilti-pair cable used for Intercom station cable. Manufacture, General cable, Essex, Comtran, Westpenn, Belden, Mohawk.

D. All wiring shall meet all local, State, and National codes.

E. For future expansion, there shall be a 35% use of available wiring capability.

F. All wires must be installed neatly and promptly, identified and marked, support wires from owner supplied "J" hooks or cable tray system. For cable drops located in hallways and in classrooms provide and install Caddy or B-line drop mounting clip to be attached to building structure or muilti-clips to support from ceiling grid wires as per local code WIRE SHALL NOT LAY ON TOP OF LIFT OUT CEILING PANELS OR LOSELY ABOVE CEILING OR IN WALLS.

END OF SECTION

SECTION 31 1100

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clearing and Cleaning Site of Plant Life, Grass, and Debris.

1.2 RELATED SECTIONS

A. Section 31 20 00 - EARTHWORK.

B. Section 32 92 00 - LAWNS AND GRASSES.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

A. Clear and Grub the Following Areas:

1. All areas which will be covered by buildings, structures, paving, or other construction, as required to clear the construction, and/or to the limits indicated.

2. Other areas, to the limits indicated.

B. In all areas requiring clearing and grubbing, completely remove all trees, stumps, roots, buried logs, brush, grass, weeds, vegetation, and other unsuitable materials. Refill to proper elevation all holes resulting from the grubbing operations, and compact the fill as specified in other sections.

C. Dispose of all spoil materials by removal to approved disposal areas on site as directed by the Engineer.

D. Clean and clear-out undergrowth and dead wood, without disturbing compaction of subsoil.

E. Burning of debris on the site shall NOT be permitted.

3.2 PROTECTION

A. Protect plant growth and features remaining as final landscaping.

B. Protect bench marks and existing work from damage or displacement.

C. Maintain designated site access for vehicle and pedestrian traffic.

END OF SECTION

SECTION 31 2000

EARTHWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove surface debris.

B. Remove topsoil and subsoil.

C. Excavation and Backfill.

D. Remove paving, curbs and other foreign materials.

E. Clear site of plant life and grass.

F. Grading.

1.2 RELATED SECTIONS

A. DIVISION 31 - EARTHWORK.

1.3 REFERENCES

A. ASTM C136 - Method of Sieve Analysis for Fine and Coarse Aggregates.

B. ASTM D2487 - Classifications of Soils for Engineering Purposes.

1.4 SUBMITTALS

A. Provide submittals under provisions of Division 01.

B. Submit test reports certifying that fill materials comply with specifications.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Work shall comply with rules and regulations of local and state agencies having jurisdiction.
   2. State and local code requirements shall control disposal of debris and excess materials.

1.6 ENVIRONMENTAL REQUIREMENTS

A. When rainy weather conditions necessitate interrupting filling and grading operations, grade and compact the surface to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, re-establish compaction specified in last layer before resuming work.

B. Conduct earthwork operations so as to prevent windblown dust and dirt and waterborne silt from interfering with the Owner's and adjacent property owner's normal operations. Assume liability for all claims related to windblown dust, and dirt caused by this Contractor's work.

1.7 SEQUENCING

A. Sequence operations so as to maintain safe operative conditions and preserve existing work which is to remain.

1.8 COORDINATION

A. Existing Conditions:
   1. Carefully maintain bench marks, monuments, and survey control references.
   2. Verify or determine locations of underground utilities and avoid damage. Should damage occur, notify the Owner and repair at no additional cost to the Contract.
   3. Restore grades disturbed by this contract activity or other causes to elevations indicated or noted on drawings or as required to provide proper drainage.

1.9 ARCHEOLOGICAL REQUIREMENTS

A. When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. At the direction of the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Contractor-Furnished Borrow Material
   1. Comply with ASTM D2487 Soil Classification groups GW, GP, GM, SM, SP, ML, and CL.
   2. Plasticity Index 20 or less and liquid limit 50 or less.

B. Fill Materials: Fill materials shall be selected earth excavated from the project site or elsewhere, or sand, or granular backfill material.

C. Granular Backfill Material:
   1. Crushed Rock:
      a. Clean mineral aggregate (broken stone, crushed or uncrushed gravel, or combination thereof).
      b. Absorption of water in saturated surface dry condition shall not exceed 3 percent of oven dry weight of sample.
      c. Graded (Laboratory sieves, US Series) to following:

Sieve Size	Percentage Passing Sieve
3/4 inch	100
No.200	8-15

   2. Sand: Clean dry concrete sand of no special grading.
   3. Drainage Rock (Gravel): Clean river wash rock; graded minimum 3/8 inch to maximum 3/4 inch, no fines.

D. All fill materials shall be free of wood, rubbish, vegetable materials, topsoil, and other unsuitable materials.

E. Geotextile Fabric: If required this shall be a woven or nonwoven synthetic, permeable barrier sheet, as manufactured by Mirafi, Inc., 140N unless otherwise indicated, or equal, which is resistant to soil, chemicals, and mildew, stable under freeze-thaw cycles, will not shrink or expand under wet conditions and will not unravel or become clogged during use. The filter cloth shall have a minimum grab tensile strength of 120 pounds in air accordance with ASTM D-1682. Fabric furnished shall be specifically selected to prevent existing soil from inter-

mixing with the granular backfill material but will allow ground water to enter the granular backfill material.

2.2 CLASSIFICATION

A. Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature, shall be used in fill areas only when approved as suitable and shaped and compacted as specified herein. Excess suitable material shall be disposed of on site at Contractor's expense, in locations specified by the Engineer.

B. Undercut Excavation. This item shall include the excavation of unsuitable subgrade material as determined by the Engineer. Unsuitable material as used here shall be defined as material that, because of its composition, cannot be compacted as specified, such as organic soil, or soil contaminated with trash or other foreign materials. Material which is found to be too moist, but is otherwise suitable material, shall not be considered unsuitable. The drying or replacement of this suitable, but too moist, material shall not be considered undercut excavation, and will not be paid for accordingly. It shall be the Contractor’s responsibility to perform processing and compaction efforts on the top 24 inches of existing subgrade prior to consideration of authorization for undercutting. Should the Contractor perform processing and compaction efforts on the top 24” and the material continue to exhibit characteristics unsuitable for embankment construction, authorization for undercutting may be determined by the Owner. In this case payment for undercut excavation shall be at the contract unit price and shall include the top 24" that was unsuccessfully processed. Material used to replace “undercut” areas shall be obtained from the grading operations or borrow areas or replaced with granular backfill material.

C. Borrow Excavation. Borrow excavation shall consist of approved material required for the construction of subgrade when insufficient quantity or quality of onsite excavation is available or when unsuitable material is encountered and undercutting is authorized. Borrow materials shall be obtained from the on-site borrow area if needed.

PART 3 EXECUTION

3.1 INSPECTION

A. The Contractor shall inspect the site and inform himself of actual grades, levels, and other conditions under which work is to be performed.

3.2 TOPSOIL REMOVAL

A. After clearing and grubbing and prior to all other earthwork, in all areas to be cut or filled including the borrow area, remove all of the existing topsoil and soil containing organic matter regardless of the depth, but in no event less than 4 inches below existing ground surface.

B. Stockpile the removed topsoil in an approved location on the project site where the stockpile will not interfere with the project construction, and protect the stockpile from erosion.

3.3 STRIPPING

A. Cut Areas: before excavating in areas (including borrow areas) from which excavated materials will be used as fill materials, strip all grass, weeds, vegetation, roots, trash, and other unsuitable materials from the existing surfaces of the areas to be cut. Remove all unsuitable materials down to the depths required to reach suitable materials, but at least 4-inch depth.

B. Filled areas: before placing fill, strip all grass, weeds, vegetation, roots, trash, and other unsuitable materials from the existing surfaces of the areas to be filled. Remove all

unsuitable materials down to the depths required to reach suitable subgrade, but at least to 4 inch depth.

3.4 EXCAVATION

A. General Requirements:
1. Excavate to dimensions and elevations shown or noted with bottoms square and true.
2. Remove debris, old foundations, tree stumps, and loose rocks from bottom of excavation.
3. Shore, brace, sheet, and slope excavations as required to prevent caving, erosion, danger to persons and structures, or interference with construction operations and as required to comply with safety laws.
4. Keep excavations free of water at all times until concrete work or backfilling is complete. Grade excavated areas to prevent ponding of water.
5. Dispose of excess material on site as directed by the Engineer.

B. Provisions for Formwork Construction:
1. Extend excavations sufficient distance from walls and footings to permit replacing and removal of forms, installation of services, and inspection.
2. Trim excavation walls and bottoms to reasonable smooth lines and grades.

C. Earth Forms: Requirements for earth forms for foundations are stated in CONCRETE FORMWORK Section.

D. Over-Depth Excavations: Fill to grade with compacted fill as directed by the Engineer/Architect or fill with concrete.

E. Removal of Below-Grade Construction or Obstructions: Remove all existing construction or obstructions wherever they occur below new grade within immediate area of new construction, new paving, or new planting areas.

F. Undercutting: Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for subgrades, roads, shoulders, or any areas intended for turfing shall be excavated to a minimum depth of 12 inches (300 mm), or to the depth specified by the Engineer, below the subgrade. Muck, peak, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of at locations on site as directed by the Engineer. This excavated material shall be paid for at the contract unit price per cubic yard for undercut. The excavated area shall be refilled with suitable material, obtained from the grading operations or borrow areas or replaced with granular backfill as directed and thoroughly compacted by rolling.

3.5 FILLING AND BACKFILLING

A. General Requirements:
1. Do not place fill or backfill until forms, rubbish and other deleterious materials have been removed, waterproofing measures completed, and areas have been approved by the Engineer.
2. Scarify surface of area to receive fill or backfill to 6 inch depth. Disc or blade surface until free from large clods.
3. Bring scarified material to proper moisture content and compact to specified density.
4. Spread fill material in layers not to exceed 8 inch depth before compaction unless compaction of thicker layers is approved by the Engineer. Sprinkle material without sufficient moisture to compact properly; permit material with excess moisture to dry to proper water content. Thoroughly mix soil and water by blading and discing before compacting.
5. Adequately brace and shore footings, walls, etc. against which backfill is to be placed to prevent displacement or damage during placement.

6. Import approved fill if site excavations do not produce sufficient quantity or approved quality.
7. There shall be NO separate payment for suitable materials removed, manipulated, and replaced in order to obtain the required depth and/or density and all costs shall be considered a subsidiary obligation of excavation. No extra payment will be made for reworking material to obtain specified density even in the event that areas which have been initially accepted for compaction require reworking due to rainfall, drying out or other reasons.

B. Minimum Compaction Requirements:
1. Compact non-granular fill materials to the density specified below a determined by ASTM D698 (Standard Proctor).
   a. Fill under foundations and concrete floors on grade: 98 percent of optimum.
   b. Fill under paving: 95 percent of optimum.
   c. General Site Fill: 90 percent of optimum.
   d. Other backfill: 90 percent of optimum.
2. Compact granular fill materials for which impact compaction will produce a well-defined moisture-density relationship curve to the density specified below as determined by ASTM D698 (Standard Proctor).
   a. Fill under foundation and concrete floors on grade: 100 percent of optimum.
   b. Fill under paving: 97 percent of optimum.
   c. General site fill: 90 percent of optimum.
   d. Other backfill: 90 percent of optimum.
3. Compact granular fill materials of a free-draining type for which impact compaction will not produce a well-defined moisture-density relationship curve to the density specified below as determined by ASTM D 4253 and D4254.
   a. Fill under foundations and concrete floors on grade: 80 percent of relative density.
   b. Fill under paving: 80 percent of relative density.
   c. General site fill: 70 percent of relative density.
   d. Other backfill: 70 percent of relative density.
4. Do not compact soil in planting areas.
5. If proper compaction techniques or adequate moisture control are not maintained by the Contractor, compactive efforts shall be repeated until satisfactory results are obtained.

3.6 BORROW MATERIALS

A. Borrow Excavation: As a part of the Lump Sum price obtain suitable borrow materials from the on-site borrow area as directed by the Engineer. Before excavating in borrow areas, strip the area as specified hereinbefore. Borrow materials shall be free of wood, rubbish, vegetable matter, topsoil, and other unsuitable and/or non-compactible materials. All borrow pits shall be opened up to expose the vertical face of various strata of acceptable material to enable obtaining a uniform product. Borrow pits shall be excavated to regular lines and they shall be drained and left in a neat, presentable condition with all slopes dressed uniformly.

3.7 MISCELLANEOUS EARTHWORK

A. Spreading Topsoil and Finish Grading:
1. After completion of rough grading and after substantial completion of other construction operations, spread the stockpiled topsoil to a 4 inch uniform depth over all areas to be seeded.
2. Before placing the topsoil, remove all construction debris, wood, concrete, and masonry materials, and other unsuitable materials, and scarify the underlying surfaces to at least 2 inch depth. Then spread the topsoil and perform all finish grading to the indicated lines and elevations, to provide smooth and uniform final surfaces.

B. Unsuitable Subgrade:
1. Where the required subgrade elevations are uncompactable or otherwise unstable and will not provide satisfactory support for the structure at the indicated soil bearing values,

extend the excavations to depths as required to reach a subgrade having at least the indicated soil bearing value. Before placing concrete, backfill the excavations up to the indicated subgrade elevations with one of the granular backfill materials specified in Paragraph 2.1 C, compacted as specified hereinbefore or filled with concrete, all as authorized by the Engineer/Architect.

C. Rock Courses:
1. Verify that all improvements such as floor drains are installed; that the subgrade has been rough graded and compacted.
2. Place rock course under building slabs to thicknesses as noted.
3. Level and compact to smooth surface.

D. Sand Beds:
1. If required, provide a compacted course of sand under concrete slabs as indicated.
2. Screed and level before reinforcing or concrete is placed.

3.8 GRADING

A. Begin grading only after debris and construction materials are removed from area concerned.

B. Grade areas to conform to contour lines and elevations indicated. Round abrupt changes in slopes. Regrade any areas that have settled to the required levels. Slope ground away from building walls.

C. Insure finished grades and surfaces drain to area drain, gutters, etc.

D. Prevent erosion of freshly graded areas during construction and until permanent drainage and erosion control measures are installed.

3.9 FIELD QUALITY CONTROL

A. The Owner will procure the services of a qualified independent testing laboratory, to perform required laboratory tests and field density tests. The Contractor shall coordinate his activities with the Owner's testing laboratory, and as a minimum will notify the testing laboratory 24 hours prior to commencing earthwork operation. As a general guide, for each lift, field density tests will be taken on each 500 square yards in pavement and building areas and on each 1,000 square yards in general site fill areas. The Contractor shall be responsible for stake-out of building and pavement areas, and areas identified for special compaction efforts, in order for the testing laboratory to determine compaction requirements. The testing laboratory will determine the frequency of field density tests to be taken, and may take more, or less than the general guidance provided above. Failing tests shall be retaken, after additional Contractor efforts, until satisfactory results are obtained. Failure to obtain the specified compaction, as documented by field density tests, shall be considered cause for the Owner to reject embankment construction.

3.10 PREPARATION OF EMBANKMENT AREA

A. Where an embankment is to be constructed to a height of 4 feet (120 m) or less, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of 6 inches (150 mm). This area shall then be compacted as indicated in paragraph 2.6. When the height of fill is greater than 4 feet (120 m), sod not required to be removed shall be thoroughly disked and recompacted to the density of the surrounding ground before construction of embankment.

B. No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the other items of work.

3.11 FORMATION OF EMBANKMENTS

A. Embankments shall be formed in successive horizontal layers of not more than 8 inches (200 mm) in loose depth for the full width of the cross section, unless otherwise approved to the Project Manager.

B. The grading operations shall be conducted, and the various soil strata shall be placed, to produce a soil structure as shown on the typical cross section or as directed. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

C. Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage.

D. The material in the layer shall be within +/-2 percent of optimum moisture content before rolling to obtain the prescribed compaction. In order to achieve a uniform moisture content throughout the layer, wetting or drying of the material and manipulation shall be required when necessary. Should the material be too wet to permit proper compaction or rolling, all work on all of the affected portions of the embankment shall delayed until the material has dried to the required moisture content. Sprinkling of dry material to obtain the proper moisture content shall be done with approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water shall be available at all times. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken for each 500 square yards. Based on these tests, the Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content in order to achieve the correct embankment density.

E. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167 or ASTM D 2922 and ASTM D 3017.

F. Compaction areas shall be kept separate, and no layer shall be covered by another until the proper density is obtained.

G. During construction of the embankment, the Contractor shall route his/her equipment at all times, both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

H. In the construction of embankments, layer placement shall begin in the deepest portion of the fill; as placement progresses, layers shall be constructed approximately parallel to the finished pavement grade line.

I. When rock and other embankment material are excavated at approximately the same time, the rock shall be removed from the project site and the other material shall be used as fill or removed from the site as applicable. Stones or fragmentary rock larger than 4 inches (100 mm) in their greatest dimensions will not be allowed in the top 6 inches (150 mm) of the subgrade. Rock or boulders shall be removed from the site at Contractor's expense.

J. When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material shall be removed from the job site.

K. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material.

L. There will be no separate measurement of payment for compacted embankment, or subgrade and all costs incidental to placing in layers, compacting, disking, watering, mixing, sloping, and other necessary operations for construction of embankments will be included in the contract price for other items.

3.12 FINISHING AND PROTECTION OF SUBGRADE

A. After the subgrade has been substantially completed the full width shall be conditioned by removing any soft or other unstable material which will not compact properly. The resulting areas and all other low areas, holes or depressions shall be brought to grade with suitable select material. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans.

B. Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall take all precautions necessary to protect the subgrade from damage. He/she shall limit hauling over the finished subgrade to that which is essential for construction purposes.

C. All ruts or rough places that develop in a completed subgrade shall be smoothed and recompacted.

D. No subbase, or surface course shall be placed on the subgrade until the subgrade has been approved by the Engineer.

3.13 HAUL

A. All hauling will be considered a necessary and incidental part of the work. Its cost shall be considered by the Contractor and included in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

B. Damages to public roads resulting from hauling operations shall be repaired, and or paid for by the Contractor. Cost of road bonds for repair and maintenance of public roads that may be required by the County, City or other jurisdiction shall be the responsibility of the Contractor.

3.14 TOLERANCES

A. General Excavation
1. Excavations shall not exceed 1/10 foot variation from dimensions and elevations shown or noted.
2. Fill and backfill shall be placed within tolerance of plus or minus 1/10 foot.
3. Grading shall be done within plus or minus 1/10 foot typically.
4. Slopes and other general grading areas to be seeded or sodded shall be graded within 3/10 foot typically.

END OF SECTION

SECTION 31 2500

EROSION, SEDIMENTATION, & DUST CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This work shall consist of the control of erosion, sedimentation, and dust resulting from the construction, including the installation and maintenance of control measures throughout the duration of the contract.
   1. The Contractor shall establish, construct, monitor, and maintain erosion and sediment control measures to prevent runoff sediments from entering waters of the State and to prevent stream damage. Siltation control devices shall be installed in the locations shown on the plans before construction begins. The erosion control structures shall be maintained until permanent ground cover is established. The Contractor, with the advice and consultation of the Engineer, shall endeavor to stop all erosion and sedimentation.
   2. Temporary erosion and pollution control shall include all construction work, haul roads or equipment storage sites.
   3. The erosion control features shall be installed prior to commencement of any other work on the site and shall be effectively maintained by the Contractor for the duration of the project.

1.2 RELATED SECTIONS

A. Section 31 20 00 - EARTHWORK.

B. Section 32 92 23 - SEEDING AND SODDING.

1.3 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following standards:
   1. Current County and City Construction Specifications.
   2. American Society for Testing and Materials (ASTM).
   3. Mississippi Department of Environmental Quality (MDEQ).

1.4 SUBMITTALS

A. Provide samples and certifications of all materials proposed for use.

1.5 PROJECT CONDITIONS

A. Damage to a stream or other natural areas is herein defined as the addition of soil, rock or top soil, whether deposited by poor construction practice, sedimentation, wind or other means; vegetable matter such as whole trees or any part thereof, or remnants from burning or other clearing processes; waste construction materials such as concrete, broken pipe, etc.; waste from construction equipment such as petroleum product spills, oil cans, damaged equipment or parts thereof; or any other additions which can be classified as detrimental to said natural areas of soil, rock, topsoil, natural vegetation, or other natural features, whether by erosion, poor construction methods or other, which can be classified as detrimental to said areas. Damage will be specified either by the Owner, or the Engineer, by actual site inspections. If it is determined that damaged has been caused by the Contractor through negligence, carelessness by intention or other, then the Contractor will act as directed by the Engineer to correct said damage as quickly as possible and to take steps to prevent further damage. Such corrections to damage will be at no extra cost to the Owner or the design professional.

PART 2 PRODUCTS

2.1 MATERIALS

A. Siltation fences shall meet the following minimum requirements and be approved by the Engineer:
   1. Posts shall be metal “T” posts, or approved equal, placed at 6' on center.
   2. Sedimentation control fabric shall be Mirafi-100X, or approved equal, with wire backing.
   3. Stakes shall be new and in good condition.

PART 3 EXECUTION

3.1 SILT FENCE:

A. Preparation:
   1. Mow and prepare areas requiring silt fences as shown on the project drawings prior to the commencement of any excavation activities.

B. Location:
   1. Silt Fence: Silt fences shall be installed in the locations indicated on the plans and where required to prevent runoff sediments from entering waters of the State. Siltation fences shall be installed prior to cleaning operations. Siltation fences shall be kept in good repair and maintained throughout construction. At a minimum, sediment shall be removed when the ponding capacity is reduced by one-half.
   2. To reduce and avoid unnecessary hauling of select soil type materials, as identified by the Contractor and Soils Engineer, the Contractor may establish temporary stockpiles within limits of construction and excavating for subsequent placement as fill in undercut areas. The Contractor shall install silt fences and/or other erosion control measures around these temporary stockpile areas to prevent soil erosion and sedimentation from impacting streams and other areas.

C. Installation Procedures:
   1. Silt Fence:
      a. Set posts firmly into soil at minimum 6' on center and excavate trench upslope along the lines of the posts.
      b. Attach the sedimentation control fabric to the wire backing and posts, and extend 10" of fabric into trench to minimum 6" depth.
      c. Backfill and compact excavated soil to top of trench.

D. Maintenance:
   1. The Contractor shall maintain, repair, and replace all silt fence and erosion/sedimentation measures throughout the contract period as directed by the Engineer.

3.2 DUST CONTROL

A. The Contractor shall exercise precautionary measures to minimize dust emissions which will include, but shall not be limited to, periodic sprinkling or wetting of the site. The Contractor has the option of using a dust palliative.

3.3 CLEANING

A. Upon completion of work, clean areas within contract limits, remove tools, erosion control fencing, and equipment. Provide site clear, clean, free of debris, and suitable for intended use.

3.4 EROSION CONTROL

A. The Contractor shall install and maintain erosion control devices in general conformance to the Erosion Control Plan. The Erosion Control Plan is provided to indicate minimum erosion control measures required of the Contractor and does not take into account the Contractor's sequence of construction. Additional erosion control measures shall be undertaken by the Contractor as required to minimize impacts to adjacent properties and the drainage system downstream of the site, at no additional cost.

B. Provide temporary silt fences between the project site, including the borrow area, and the adjacent drainage system for the purpose of erosion control.

C. The temporary silt fence shall consist of woven wire fence attached to posts with geotextile fabric attached to the upper grade side of the fence. The geotextile fabric shall be anchored into the soil.

D. Riprap for miscellaneous erosion control measures, such as energy dissipation at pipe outlets and stone check dams, shall be dumped or hand placed, in locations indicated on the plans or as directed by the Engineer. Filter fabric for riprap shall be considered incidental to the installation of the riprap.

E. Seeding for erosion control shall be placed in accordance with Section 32 92 00 and per MDEQ requirements.

F. Erosion control structures shall be maintained in satisfactory condition until an approved cover of grass is established to prevent erosion, for the duration of the project, or until removal is approved, whichever occurs first.

G. The Contractor shall provide erosion control measures necessary to satisfy the governing jurisdictional agencies (local municipality, DeSoto County, or the Mississippi Department of Environmental Quality).

H. If required, the Contractor shall be listed, as responsible entity, the "Storm Water Pollution Prevention Plan", SWPPP. The Engineer shall prepare the SWPPP for signature. The Contractor shall be required to sign, as the responsible entity, the Notice of Intent (N.O.I.).

I. Any fines or penalties resulting from the discharge of sediment to waters of the State, or inadequate erosion control shall be paid by the Contractor. This applies to actions taken by local authorities, State agencies and Federal agencies, and includes action taken against the Owner or Contractor.

END OF SECTION

SECTION 31 3116

TERMITE CONTROL

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. Soil treatment with termiticide.

1.3 SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

B. Qualification Data: For qualified Installer.

C. Product Certificates: For termite control products, from manufacturer.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

E. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located**,** and who employs workers trained and approved by manufacturer to install manufacturer's products.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: **Five** years from date of Final Completion.

1.7 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide a proposal for continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation, Agricultural Products; Termidor.
b. Bayer Environmental Science; Premise 75.
c. FMC Corporation, Agricultural Products Group.
d. Syngenta.

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than **five** years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements**,** interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

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

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 32 1613

CONCRETE CURBS, GUTTERS, AND SIDEWALKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prepare sub-grade to receive materials for the work described herein.

B. Provide formwork and embedded items as noted or required.

C. Provide concrete and miscellaneous items as required and specified herein.

1.2 RELATED SECTIONS

A. DIVISION 31 - EARTHWORK.

B. Section 31 20 00 - EARTHWORK.

C. Section 32 11 00 - ASPHALTIC CONCRETE PAVING.

D. Section 32 17 23 - PAVEMENT MARKING.

E. DIVISION 03 - CONCRETE.

1.3 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

C. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

D. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

E. AASHTO M173 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

F. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

G. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

H. ASTM C33 - Concrete Aggregates.

I. ASTM C94 - Ready Mix Concrete.

J. ASTM C150 - Portland Cement.

K. ASTM C260 - Air-Entraining Admixtures for Concrete.

L. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

M. ASTM C494 - Chemical Admixtures for Concrete.

N. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

O. ACI 302 - Guide for Concrete Floor and Slab Construction.

P. ACI 305 - Hot Weather Concreting.

Q. ACI 306 - Cold Weather Concreting.

R. Mississippi State Highway Department - "Mississippi Standard Specifications for Road and Bridge Construction".

1.4 SUBMITTALS

A. Submit test reports certifying that materials comply with specifications.

B. Submit concrete mix and test reports of mix cylinder test.

C. Submit test reports of job cylinder tests.

D. Submit samples of color - conditioned concrete for approval.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: All work shall comply with rules and regulations of local and state agencies having jurisdiction.

1.6 JOB CONDITIONS

A. Existing Conditions: Carefully maintain bench marks, monuments, and survey control references.

1.7 INSPECTION AND TESTING

A. Inspection and testing of concrete will be performed by a qualified testing laboratory obtained and paid for by the Owner.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150; normal - Type I.

B. Fine and Coarse Aggregates: Section 703 "Mississippi Standard Specifications for Road and Bridge Construction".
   1. Fine aggregates shall be natural sand, or sand prepared from stone, or other inert materials having similar characteristics as approved.
   2. Coarse shall be crushed, washed limestone only.

C. Water: Clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

D. Air Entrainment: ASTM C260 or AASHTO M-154. Air entraining admixtures shall be added to the mixer in the amount necessary to produce the specified air content.

E. Color admixtures: Uniform Building Code Water reducing components in accordance with ASTM C494.

2.2 REINFORCEMENT

A. Reinforcing Steel: 60 ksi (414 MPa) yield strength; deformed billet steel bars; ASTM A615; Plain finish.

B. Welded Steel Wire Fabric: ASTM A185 or AASHTO M-55.

C. Tie Wire: Minimum 16 gauge annealed type, or patented system acceptable to Engineer/Architect.

2.3 FORMWORK AND ACCESSORIES

A. Formwork: Steel or two inch lumber matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete.

B. Joint Filler: Minimum ½ inch thick asphaltic impregnated fiberboard, ASTM D1751.

C. Concrete Curing Compound: Chlorinated rubber type; clear color with fugitive dye; ASTM C308 type as recommended by manufacturer.

D. Expansion Joint Sealant: Exterior self-leveling polyurethane for horizontal joints shall be one of the following types or approved:
1. Chem-Caulk 500, FS TT-S-00227E, Type II, Class A, two part.

2.4 CONCRETE MIX

A. Mix and proportion to produce minimum 4,000 psi concrete at 28 days with maximum slump of three inches (76 mm) and six percent (±1 percent) air entrainment; ASTM C94 or as indicated on drawings.

B. Use accelerating admixtures in cold weather only when acceptable to Engineer/Architect. Use of admixtures shall not relax cold weather placement requirements. Do not use calcium chloride.

C. Use set-retarding admixtures during hot weather only when acceptable to Engineer/Architect.

PART 3 EXECUTION

3.1 PREPARATION OF SUB-GRADE

A. Insure rough grading has brought sub-grade to required elevations.

B. Fill soft spots and hollows with required compacted additional fill materials.

3.2 FORMING

A. Form vertical surfaces to full depth and securely position to required lines and levels. Insure form ties are not places so as to pass through concrete. Cross forms shall be 1/8 inch steel extending the full depth and width of the work.

B. Arrange and assemble formwork to permit easy dismantling and stripping, and to prevent damage to concrete during formwork removal.

3.3 FORMING EXPANSION AND CONTRACTION JOINTS

A. Place expansion joints at a maximum 40 foot (12.2 m) and contraction joints at 10 foot (6.10 m) intervals for curbs. Where possible, make joints of curbs coincide with joints in walks. Place expansion joints at maximum of 24 feet for sidewalks.
   1. Expansion joints shall be placed at the following locations:
      a. Between curbs and sidewalks.
      b. Between sidewalks and buildings or columns.
      c. Between sidewalks and ramps.
      d. All locations as indicated on the plans and details.

B. Fit expansion joints with filler to required profiles, set perpendicular to longitudinal axis. Recess ½ inch below finished concrete surface to all expansion joint sealant to be properly poured in place.

C. Grooves in Sidewalks: Between expansion joints, cut grooves 1/4 inch wide and at least 1/4 inch deep, as follows:
   1. In walks not wider than six feet, transverse grooves with a spacing approximately equal to the walk width, but not less than four feet, per construction planst.
   2. In walks wider than six feet, transverse grooves with a spacing approximately equal walk width, per construction plans.

3.4 PLACING CONCRETE

A. Place concrete, screed and wood float surfaces to a smooth and uniform finish, free of open texturing and exposed aggregate.

B. Avoid working mortar to surface.

C. Round all edges, including edges of dummy and expansion and contraction joints, with 1/4 inch (6.3 mm) radius edging tool.

D. Insure finished surfaces do not vary from true lines, levels or grade by more than 1/8 inch in 10 feet (3 mm in 3 m) when measured with straight edge.

E. Protection: Remove no forms for 24 hours after pouring concrete. Protect concrete walks from pedestrian traffic for a period of three days after pouring.

F. Place and finish color-conditioned concrete in accordance with the manufacture's requirements.

3.5 FINISH

A. General: The concrete shall be struck-off, consolidated, and finished in such a manner that after final finishing, it shall conform to the cross section shown on the Plans. Hand finishing of pavements will be permitted in narrow widths, areas of irregular dimensions, and in the event of breakdown of the mechanical equipment, to finish the concrete already deposited on the grade.

B. Final Surface Finish:
   1. Sidewalks shall have a uniform broomed finish.
   2. Curbs or curbs and gutters shall have a wood float finish.

3.6 CURING

A. General: After finishing operations have been completed and immediately after the free water has left the surface, the surface of the sidewalks, curb, or curb and gutter shall be coated and sealed with a uniform layer of membrane curing compound applied as recommended by the

manufacturer. When the forms are removed, curing compound shall be applied to the side of the slab.

1. Areas in which the curing membrane is damaged within a period of three days shall be resprayed with curing compound.
2. Curing compound may be omitted when the concrete is otherwise protected from inclement weather for three days.

B. Impervious Membrane: Concrete shall be cured through the application of a transparent, impervious membrane of a type approved by the Engineer/Architect. The liquid shall contain a fugitive dye and shall be of such composition as not to react with the concrete nor alter appreciably its natural color. Apply the liquid immediately after free water has disappeared from the finished surface of the concrete; apply in a fine mist and in such manner as to cover the surface with a uniform, flexible film, ample to seal the surface thoroughly, and without marring the concrete finish. Keep workmen, equipment, and materials off the membrane for three days after applying.

C. Cold Weather Protection: Whenever the air temperature may be expected to reach the freezing point, spread straw or other blanketing material to sufficient depth to keep concrete from freezing, or provide enclosure and heating device capable of maintaining concrete temperature of at least 50 degrees Fahrenheit. Maintain such protection for at least five days. The Contractor shall be responsible for removing and replacing any concrete injured by frost action.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by the Owner’s testing laboratory.

B. Three concrete test cylinders will be taken for every 35 or less cubic yards (58 or less cubic meters) of concrete placed.

C. One additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

END OF SECTION

SECTION 32 1723

PAVEMENT MARKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provision of traffic and symbol marking paint.

1.2 SUBMITTALS

A. Submit manufacturer's literature describing products.

B. Samples: Only as requested.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.

B. Store and mix all materials in ventilated areas as directed. Remove all empty containers, waste, and rags from premises overnight.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pavement Marking Paint shall be in accordance with the Mississippi Department of Transportation Standard specifications for Road and Bridge construction (Latest Edition).

PART 3 EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Apply painted pavement markings in accordance with the Mississippi Department of Transportation Standard specifications for Road and Bridge Construction (Latest Edition).

END OF SECTION

SECTION 32 9200

LAWNS AND GRASSES

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide sodded lawns and seeded areas as shown and/or specified on the drawings. The work includes:
   1. Soil preparation.
   2. Sodding lawns and other indicated areas.
   3. Seeding areas as indicated.
   4. Maintenance.

1.2 RELATED SECTIONS

A. Related sections include the following:
   1. Section 32 9223 – SODDING.

1.3 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, Brome Grass and depending upon situation and location Bermuda Grass.

1.4 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

B. Sod Producer: Company specializing in sod production and harvesting with minimum five (5) years documented experience, and certified by the State of Tennessee.

C. Sod: Type specified on drawings with a minimum of six (6) months of root development that will support its own weight, without tearing, when suspended vertically by holding the upper two (2) corners.

D. Submit sod certificate to Owner and Architect for grass species and location of sod source.

E. Lawn Seed: Lawn seed mixture shall be fresh, clean, new crop seed. The Contractor (Installer) shall furnish to the Landscape Architect the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

F. Submit seed vendor's certification for required grass seed mixture, indicating percentage by weight, purity figure, germination figure, and weed seed figure for each grass species.

1.5 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer, pesticide and herbicide composition and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Lay sod as soon as it is delivered to planting areas. Lay only healthy, moist, green sod. Any sod which is brown and under stress is unacceptable. Any sod which is not laid within twenty four (24) hours of delivery is unacceptable.

C. Deliver seed materials in original unopened containers, showing weight, analysis, and name of manufacturer.

D. Deliver fertilizer in original, unopened, waterproof containers showing weight, manufacturer's guaranteed chemical analysis and name of manufacturer.

E. Store seed and fertilizer in a manner that prevents wetting and deterioration.

1.7 MAINTENANCE SERVICE

A. Maintenance services: Performed by Contractor (Installer).

B. Maintenance shall commence when specified areas have been sodded or seeded and shall continue until final acceptance.

C. Maintain sodded and seeded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding or reseeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease and insects is achieved and is accepted by the Owner.

D. Replace any unacceptable sodded or seeded areas during the maintenance period at no cost to the Owner.

1.8 MAINTENANCE DURING CONSTRUCTION

A. Maintain sodded areas immediately after placement and assure grass is well established and exhibits a vigorous growing condition.

B. After grass growth has started all areas or parts of areas which fail to show a uniform stand of grass, for any reason whatsoever, shall be resodded or reseeded in accordance with the plans and as specified herein. Such areas and parts of areas shall be resodded or reseeded repeatedly until all areas are covered with a satisfactory growth of grass at no additional cost to the Owner.

C. For seeded areas, watering shall be done in such a manner and as frequently as is deemed necessary by the Landscape Architect to assure continued growth of healthy grass. All areas and parts of areas shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass at no additional cost to the Owner.

D. Water for the execution and maintenance of this work shall be provided by the Owner at no expense to the Contractor (Installer). The Contractor (Installer) shall furnish his own portable tank, pumps, hoses, pipes, connections, nozzles, and any other equipment required to transport the water from the available outlets and apply it to the seeded areas in an approved manner.

E. Mowing of the seeded areas shall be initiated when the grass has attained a height of one and one half to two inches (1 ½"-2"). Grass height shall be maintained between one and one half to two inches (1 ½"-2") at subsequent cuttings depending on the time of year. Not more than one third (1/3) of the grass leaf shall be removed at any cutting, and cutting shall not occur closer than ten (10) days apart.

F. When the amount of grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threatens to smother the planted species, such vegetation shall be mowed or in the case of rank growths, shall be uprooted, raked and removed from the area by methods approved by the Landscape Architect.

G. Protect grassed areas against trespassing while the grass is becoming established. Furnish and install fences, signs, barriers or any other necessary temporary protective devices. Damage resulting from trespass, erosion, washout, settlement or other causes shall be repaired by the Contractor (Installer) at no additional cost to the Owner.

H. Remove all fences, signs, barriers or other temporary protective devices promptly after final acceptance.

PART 2 PRODUCTS

2.1 SOD MATERIALS

A. Sod: Type as specified on drawings, certified grade, cultivated grass sod; Species per plan with strong fibrous root system, free of stones, burned or bare spots, and weeds.

2.2 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with ASPA guidelines.

B. Cut sod in area not exceeding one square yard (1 sq. yd.), with minimum one-half inch (1/2") and maximum one inch (1") topsoil base.

2.3 SEED MIXTURE

A. Seed type as specified on drawings shall meet the requirements of applicable seed laws and shall be tested in accordance with the most current edition of the U. S. Department of Agriculture Handbook No. 30, Testing Agricultural and Vegetable seed. Seed shall be from the last preceding crop and comply with the requirements outlined below for purity and germination. Each variety of seed shall be furnished in separate, strong bags with each bag being fully tagged or labeled to show the variety, weight, purity figure, germination figure, and test data prescribed by law. All test results shall be fully certified by the vendor or by a recognized seed testing agency. Seeds found not to comply with specification requirements shall be subject to rejection.

B. Seeding materials shall be free from foreign weed, seeds or bulbets.

C. Seed species shall not contain more than six (6) seeds per ounce of the seed of any noxious weeds.

D. Seed species shall not contain an excess of two percent (2%) by weight of weed seeds, noxious or otherwise.

E. Seed Mixtures, Rates and Seasons: Seed mixture, rates and seasons shall be those specified on the drawings. The types to be used for each area are specified by the drawings.

2.4 PROMIX

A. Promix shall be a mix of sandy loam, pine fines, mulch fines, compost and sand.

2.5 TOPSOIL

A. Excavated from site and free of weeds and debris. If sufficient quantities are not available on site, import as required.

2.6 MULCHING MATERIAL

A. Dry oat or wheat straw, free from weeds and/or foreign matter detrimental to plant life. Hay or chopped cornstalks are not acceptable.

2.7 FERTILIZER

A. Federal Specification O-F-241, Type 1, grade A; recommended for grass, with fifty percent (50%) of the elements derived from organic sources and of proportion necessary to eliminate any deficiencies of topsoil as indicated in analysis.

2.8 WATER

A. Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.9 EROSION FABRIC

A. Jute matting, open weave. Poly jute 465GT by Synthetic Industries, Contech excelsior Blanket (Standard grade) or approved equal.

2.10 HERBICIDE

A. Type approved by Landscape Architect.

2.11 STAKES

A. Stakes –Use where sod slopes greater than 3:1 or in drainage swales.
   1. Softwood, ¾" dia. X 8" long or,
   2. Steel, tee shaped pins, 4"head x 8" leg.

PART 3 EXECUTION

3.1 TESTS

A. Provide analysis of topsoil.

B. Perform soil testing prior to the installation of any sod.

C. Collect and submit minimum of ten ounce (10 oz) sample of proposed topsoil. Forward sample to testing laboratory in sealed containers to prevent contamination.

D. Collect soil samples representative of all areas where sod is specified.

E. The soil test report should provide the following data: Water pH, soil test rating for available Phosphorus, Potassium, Calcium, Magnesium, Zinc, Iron and Manganese, percentage of organic matter, soluble salts, and recommendations on type and quantity of additives required to establish satisfactory pH factor and supply nutrients to bring soil up to a satisfactory level for sustained health and growth of the specified sod or seed.

F. Provide results of these tests to Owner and Architect.

G. Contractor (Installer) to amend the soil as needed based on results of the soil test.

3.2 INSPECTION

A. Verify that prepared soil base is ready to receive the work of this section.

B. Beginning of installation means acceptance of existing site conditions.

3.3 PREPARATION OF SUBSOIL

A. Prepare subsoil during dry weather and on dry unfrozen subgrade to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove any existing turf grass, foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.

C. Thoroughly till soil to depth of four inches (4”) with six cubic foot (6 cu. ft.) of Pro Mix, twenty five pounds (25 lbs.) of a complete fertilizer and one cubic yard (1 cu. yd.) of sand per thousand (1000 sq. ft.) square feet.

D. Following this, the area shall be fine graded to remove all ridges and depressions and the surface cleared of all stones, weeds, sticks and other debris.

3.4 FERTILIZING

A. Apply approved fertilizer in accordance with manufacturer’s instructions

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Apply fertilizer no more than twenty four (24) hours before laying sod.

D. Mix thoroughly into upper four inches (4”) of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.5 LAYING SOD

A. Clearly define all document areas to receive sod.

B. Moisten prepared surface immediately prior to laying sod.

C. Lay sod within twenty four (24) hours after harvesting to prevent deterioration.

D. Lay sod tight with no open joints and no overlapping; stagger end joints twelve inches (12”) minimum. Do not stretch or overlap sod pieces.

E. Lay smooth. Align with adjoining grass areas.

F. Top dressing with clean, weed-free sand may be required as deemed necessary by the Landscape Architect.

G. Water sodded areas immediately after installation. Saturate sod to four inches (4”) of soil depth.

H. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.6 SEEDING

A. Define all document areas to receive seed.

B. Broadcast one-half (1/2) of the seed as uniformly as possible over the entire prepared area. Sow remaining seed in a direction perpendicular to the initial sowing. Rake in lightly. Do not seed areas larger than that which can be mulched on the same day.

C. Planting Season: Season based on specified seed type.

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Roll seeded area with roller not exceeding one hundred twelve pounds (112 lbs.).

F. Immediately following seeding and compacting, apply mulch to a thickness of one-eight inch (1/8”). Maintain clear of shrubs and trees.

G. Apply water with a fine spray immediately after each area has been mulched with mulching material. Saturate the top four inches (4”) of soil.

H. Any areas which wash, blow away or do not germinate are to be re-graded and re-seeded until area is covered adequately.

I. If the project completion date prohibits in-season planting, the Contractor (Installer) shall prepare himself for temporary out of season seeding or sodding, so that all lawns shall be completed and ready for acceptance at time of project completion, without additional cost to the Owner. Permanent seeding as specified in this document shall be completed as soon as practical (when proper season occurs). Lawn maintenance shall be the same as for other planting.

J. In the event that lawn operations are completed too late in the fall for adequate germination and/or growth, maintenance shall continue into the following growing season or until a uniform stand of the specified grasses has been established.

3.7 SEED PROTECTION

A. Identify seeded areas with forty inch (40”) height (above grade) stakes and string around area periphery. Set string height to thirty six inches (36”). Attach twelve inch (12”) sections of pink glow survey ribbon every thirty six (36”) inches along string.

B. Cover seeded slopes where grade is four inches (4”) per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in six inch (6”) deep excavated topsoil trench. Provide twelve inch (12”) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edged and overlaps at thirty six inch (36”) intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

3.8 MAINTENANCE

A. Maintain all sodded and seeded areas until there is a stand of grass acceptable to both the Owner.

3.9 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 40 00 – Quality Requirements

B. Upon completion of work, notify Owner and Architect at least ten (10) working days prior to requested date of inspection. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until work is re-inspected by Architect and found to be acceptable.

C. Upon satisfactory completion of repairs and/or replacements, the Architect shall certify, in writing, the acceptance of the work in total.

END OF SECTION

SECTION 32 9223

SODDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide all labor, materials, and equipment to install topsoil, including but not limited to:
   1. Prepare sub-grade to receive topsoil.
   2. Place, rake, and level topsoil as required to prepare for sod.
   3. Place sod.
   4. Maintain sod.

1.2 RELATED SECTIONS

A. DIVISION 31 - EARTHWORK.

B. Section 31 20 00 - EARTHWORK.

C. Section 32 16 13 - CONCRETE CURBS, GUTTERS, AND SIDEWALKS.

D. Section 32 92 00 - LAWNS AND GRASSES.

1.3 QUALITY ASSURANCE

A. Test top soil in accordance with the requirements of the local Agricultural Department to evaluate the required and recommended fertilizer to properly substantiate sodding.
   1. Supply written analysis stating N, P, and K requirements, organic matter content, pH value of soil, and lime requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver sodding on pallets as recommended by ASPA.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.5 EXISTING CONDITIONS

A. Beginning work means acceptance of existing conditions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sod:
   1. Obtain sod from reasonable fertile loamy topsoil areas where the sod has a good cover of living or growing Bermuda grass; sod shall be free of weeds, rocks, roots, and other materials which could interfere with the sod development and its future maintenance. Remove sod in conveniently handled equal width rectangular sections, with native soil retained on roots.
   2. Liming and fertilizing:
      a. Lime: shall be as required by Topsoil Testing as specified hereinbefore under Article 1.3 - QUALITY ASSURANCE.

3. Water: clean, fresh, and free of substances or matter which would inhibit vigorous growth of grass.

2.2 CUTTING SOD

A. Cut sod using an approved method, in accordance with local governing American Sod Producers Association. Cut sod in pieces not exceeding one square yard (one square meter), with minimum ½ inch (13 mm) and maximum one inch (25 mm) soil portion. Transport sod within 24 hours after it is stripped.

PART 3 EXECUTION

3.1 PREPARATION OF SUB-GRADE

A. Fine grade sub-grade, eliminating uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, undesirable plants and their roots, stones, and debris. Do not bury foreign material beneath areas to be sodded. Remove sub-soil which has been contaminated with petroleum products.

C. Cultivate sub-soil to a depth of 3 inches (76 mm) where sod is to be placed. Repeat cultivation in areas where equipments, used for hauling and spreading topsoil, has compacted sub-soil.

3.2 PLACING TOPSOIL

A. Spread topsoil to a depth of minimum 4 inches (102 mm) over entire area to be sodded.

B. Place topsoil during dry weather and on dry unfrozen sub-grade.

C. Grade to eliminate rough and low areas, ensuring positive drainage. Maintain levels, profiles, and contours of sub-grade.

D. Remove stones, roots, grass, weeds, debris, and other foreign nonorganic material while spreading.

3.3 FERTILIZING

A. Apply fertilizer at a rate recommended by manufacturer and the recommendations of American Sod Producers Association. Apply after fine grading. Mix thoroughly into upper 2 inches (51 mm) of topsoil.

B. Lightly water to aid the breakdown of fertilizer.

C. Apply fertilizer within 48 hours before laying sod.

3.4 LAYING SOD

A. Lay sod closely knit together with no open joints visible and pieces not overlapped. Lay smooth and flush with adjoining grass areas, paving, and top surfaces of curbs.

B. On slopes 2:1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet (610 mm) on center. Drive pegs flush with soil portion of sod.

C. Immediately water sodded areas after installation. Water in sufficient amounts to saturate sod and upper 4 inches (102 mm) of soil.

D. After sod and soil has dried sufficiently to prevent damage, roll sodded areas to insure good bond between sod and soil and to remove minor depressions and irregularities. Insure rolling equipment weight not over 250 pounds (113 kg) or less than 150 pounds (68 kg).

3.5 MAINTENANCE

A. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition and until acceptance by the Engineer/Architect.

B. Mow grass at regular intervals as required to maintain at a maximum height of 2-1/2 inches (64 mm). Do not cut more than 1/3 of grass blade at any one mowing. Neatly trim edges and hand clip where necessary. Immediately remove heavy clippings after mowing and trimming.

C. Water when required and in sufficient quantities to prevent grass and underlying soil from drying out.

D. Roll when required to remove minor depressions or irregularities.

E. Control growth of weeds. When using herbicides, apply in accordance with manufacturer's recommendations. Remedy damage resulting from negligent or improper use of herbicides.

F. Immediately repair or replace any areas which show deterioration or bare spots.

G. Protect sodded areas with warning signs during maintenance period.

END OF SECTION

SECTION 33 1100

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide fire main and domestic water pipe up to five (5) feet of the building.

B. Provide valves and boxes.

C. Provide fire hydrants.

D. Provide required fittings.

E. Provide Lines, Grades, Stakes, and Templates.

F. Provide backflow preventers.

G. Provide heated and insulated enclosures.

H. Provide siamese fire department inlet connections.

1.2 RELATED SECTIONS

A. Section 31 20 00 - EARTHWORK.

B. Section 33 13 00 - DISINFECTION OF WATER DISTRIBUTION LINES.

C. DIVISION 03 - CONCRETE.

1.3 REFERENCES

A. AWWA C104: cement mortar lining for ductile iron pipe and fittings for water.

B. AWWA C110: ductile iron and gray iron fittings.

C. AWWA C500: gate valves, for water and sewage systems.

D. AWWA C504: rubber seated butterfly valves.

E. AWWA C600: installation of ductile iron water mains and their appurtenances.

F. ASTM D2241: poly (vinyl chloride PVC) pressure rated pipe (SDR Series).

G. ASTM C94: ready mix concrete.

H. AWWA C900: polyvinyl chloride (PVC) pressure pipe 4 in. through 12 in. for water.

I. AWWA M23: “PVC Pipe - Design and Installation.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: All work shall comply with rules and regulations of local and state agencies having jurisdiction.

B. That portion of the water piping designated as fire main shall be installed by a fire protection contractor licensed in the State of Mississippi. Installation shall be in accordance with NFPA-24.

1.5 JOB CONDITIONS

A. Existing Conditions: Carefully maintain benchmarks, fences, roads, traffic, monuments, and survey control references.

1.6 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01.

B. Equipment and Materials Which Will Be Installed Outdoors: At all times prior to its installation, store this equipment and these materials on pallets, skids, runners, platforms, or other suitable supports which will hold all parts of this equipment and these materials at least six inches above ground; provide watertight coverings for those stored items which may be damaged by rain or snow; all as approved.

C. Payment for Stored Materials and Equipment: No payment will be made for on-site or off-site stored materials and equipment which are not stored as specified above.

D. Submit in triplicate, certificates from the manufacturers certifying that all pipe and fittings furnished for this contract comply with these specifications.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Tapping Sleeves and Valves:
      a. Grinnel Corp.; Mueller Co.; Water Products Div.
      b. McWane Inc.; Clow Valve Co. Div. (Oskaloosa)
      c. McWane Inc.; Kennedy Valve Div.
   2. Gate Valves:
      a. Grinnel Corp.; Grinnel Supply and Sales Co.
      b. Grinnel Corp.; Mueller Co.; Water Products Div.
      c. McWane Inc.; Clow Valve Co. Div. (Oskaloosa)
      d. McWane Inc.; Kennedy Valve Div.
      e. McWane Inc.; Tyler Pipe, Utilities Div.
      f. Milwaukee Valve Co., Inc.
      g. Stockham Valves & Fittings, Inc.
   3. Indicator Posts and Indicator Gate Valves:
      a. Grinnel Corp.; Grinnel Supply and Sales Co.
      b. Grinnel Corp.; Mueller Co.; Water Products Div.
      c. McWane Inc.; Clow Valve Co. Div. (Oskaloosa)
      d. McWane Inc.; Kennedy Valve Div.
      e. Stockham Valves & Fittings, Inc.
   4. Fire Hydrants:
      a. Grinnel Corp.; Mueller Co.; Water Products Div.

b. McWane Inc.; Clow Valve Co. Div. (Oskaloosa)
c. McWane Inc.; Kennedy Valve Div.
d. Waterous

5. Storz Fire Department Inlet Connections:
   a. Elkhart Brass Mfg. Co.; Inc.
   b. Fire-End and Croker Corp.
   c. Smith Industries, Inc.; Potter-Roemer Div.
6. Backflow Preventers:
   a. Ames Co., Inc.
   b. Grinnel Corp.; Mueller Co.; Hersey Products Div.
   c. Watts Industries, Inc.: Water Products Div.
   d. Zurn Industries, Inc.; Wilkins Div.
7. Keyed Couplings:
   a. McWane Inc.; Tyler Pipe; Gustin-Bacon Div.
   b. Victaulic Co. of America
   c. Grinnel Corp.; Gruvlok; Grinnel Supply and Sales Co.
8. Protective Enclosures:
   a. Aqua Shield.
   b. Hot Box.
   c. HydroCowl, Inc.

2.2 TYPES OF PIPE TO BE USED

A. Types of pipes for various locations and usages shall be:
   1. Service Pipe: Service Pipe shall be Schedule 80 PVC.
   2. Fire Protection Pipe:
      a. Exterior to within five feet of building or backflow preventer enclosure pad: C900 PVC pipe (DR18).
      b. Above grade and within five feet of building or backflow preventer enclosure panel: Ductile iron.

2.3 DUCTILE IRON PIPE, FITTINGS, AND JOINTS

A. Pipe: Ductile iron pipe shall conform to AWWA Specification C151, and shall have at least 150 psi working pressure rating. Ductile iron pipe (hereinafter referred to as “iron pipe”) shall have AWWA Specification C104 standard thickness bituminous sealed cement mortar lining, bituminous outside coating, and ends as required for the joint types specified or indicated for the various pipe locations and applications. MINIMUM wall thickness and MINIMUM pressure classes at all points, including in bottoms of surface depressions, shall be as tabulated below.

Pipe Size	Wall Thickness	Pressure Class
4"	0.25"	350
6"	0.25"	350
8"	0.25"	350

   1. For each individual laying length of iron pipe having threaded ends for screwed-on flanges or grooved ends for locking type joints, the pipe wall thickness shall be at least as recommended by the pipe manufacturer to provide ample strength in the thread roots or groove bottom to safely accommodate the pressure and other conditions involved, but in no case shall the pipe wall thickness before threading or grooving be less than the minimum wall thickness specified above for the size and type of pipe involved.

B. Fittings for Ductile Iron Pipe: These shall be ductile iron short body pattern conforming to AWWA Specification C110 or C153 as applicable, or full Class 150 or heavier, with AWWA Specification C104 standard thickness bituminous sealed cement mortar lining, bituminous

outside coating, and ends as required for the joint types specified or indicated for the various pipe locations and applications.

C. Joints: Except as otherwise specified or indicated, joints in iron pipe and iron fittings shall be AWWA Specification C111 mechanical type, with plain rubber gaskets. Where above slab-on grade or in pit, iron pipe and/or iron fittings shall have ANSI Class 125 faced and drilled flanged ends. Screwed-on flanges for iron pipe shall be especially designed and sized for iron pipe, with counterboard long hubs completely covering the pipe threads. Gaskets shall be plain rubber; bolts shall be standard square or hexagon head steel, with standard steel hexagon nuts. Each joint shall have a retainer gland equal to “Megalug” by EBAA Iron, Inc., Eastland, Texas consisting of a specifically designed ductile iron mechanical joint follower glad with multiple wedging action restraining mechanisms with a minimum working pressure of 250 psi. Gland shall be suitable for use with a standard mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11. Twist off nuts shall be used to indicate proper torque of the restraining wedges.

2.4 PVC PIPE, FITTINGS, AND JOINTS

A. Pipe: Pipe shall be made of Type 1 Grade 1 material conforming to ASTM D 1784, NSF approved and so labeled and with ends as specified below.
   1. Service Pipe: This shall be Schedule 80 PVC conforming to ASTM Specification D 1785.
   2. Fire Main Pipe: This shall be Class 150 (DR 18) conforming to ASTM Specification C900.

B. Fittings: These shall be PVC type, for water main and iron type for fire main, each with pressure rating at least equal to that of the pipe, and with ends as specified below.
   1. PVC fittings (water main only): These shall be made of the same material as that of the pipe involved, shall have pressure rating not less than that of the pipe involved, and shall have integral bells.
   2. Iron fittings (Fire main): these shall be ductile iron short body pattern conforming to AWWA Specification C110, with AWWA Specification C104 standard thickness bituminous sealed cement mortar lining, bituminous outside coating, and ends as required for the joint types specified or indicated for the various pipe locations and applications.

C. Joints:
   1. Pipe-to-pipe joints: these shall be push-on type, with beveled spigot ends, bells having gasket retaining grooves, and rubber gaskets, to facilitate field assembly and to permit free expansion and contraction at each joint. Pipe shall have integral bells, or pipe may be Plain end type coupled with suitable double-bell couplings made of same material as that of pipe involved and having pressure rating not less than that of pipe involved.
   2. Pipe-to-PVC fitting joints: these shall be push-on type, with rubber gaskets.
   3. Pipe-to-iron fitting joints: these shall be AWWA Specification C111 push-on or mechanical type, with Plain rubber gaskets.
   4. Solvent welded joints: THESE WILL NOT BE PERMITTED.

D. Fire Hydrant Tees: Tees for connecting fire hydrants to PVC mains shall be as specified in paragraph B. 2. above, with AWWA Specification C111 ends as follows, and Plain rubber gaskets: branch outlet, spigot type with locked-on rotatable gland ring, suitable for connecting and anchoring to a mechanical joint bell-end cut-off valve; and on-the-run ends, push-on or mechanical joint type.

E. Adapter Fittings: Provide suitable PVC or ductile iron adapter fittings as required to connect PVC pipe to other types of pipe.

2.5 CUT-OFF VALVES AND VALVE BOXES

A. General: For each location where a certain type of cut-off valve is specified, indicated, or required for the application involved, provide the appropriate type accordingly. OTHERWISE, cut-off valves shall be gate type.

B. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine. Method of tapping shall be in accordance with the local utility requirements.
   1. Tapping sleeve: Cast-or ductile-iron, 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical-joint ends with rubber gaskets or sealing rings in sleeve body. Include sleeve matching size and type of pipe material being tapped and of outlet flange required for branch connection.

C. Gate Valves: These shall be iron body, bronze mounted, double disc, parallel seat, non-rising stem type, for at least 175 psi working pressure, conforming to AWWA Specification C500, of Mueller, M & H, or as approved make. Each valve shall have "O" ring type stem seal, standard two inch AWWA operating nut, and shall be opened by COUNTER-CLOCKWISE stem rotation. Except where otherwise specified, indicated, or required for the application involved, all gate valve ends shall be AWWA Specification C111 mechanical joint type, with Plain rubber gaskets.

D. Valve Boxes: These shall be standard cast iron two-piece 5-1/4 inch inside shaft diameter screw adjustable type, each consisting of a cover marked WATER, an upper telescoping section, and a lower section. Where necessary to provide extra depth, provide cast iron extension pieces as required. Valve boxes over main valves shall be Mueller Standard or equal.

E. Post Indicator Valve: Provide where indicated on drawings, a two-piece post indicator valve for non-rising stem gate valve, UL listed and FM approved (Grinnell No. 1430 or approved equal, with two inch operating nut and extension rod (length as required); and with signs inside window showing valve as "OPEN" or "SHUT". Post indicator shall be furnished and installed complete with operating wrench locked to the operator with valve in the open position.

2.6 ABOVEGROUND PIPE AND FITTINGS

A. Ductile iron with flanged joints as specified in Paragraph 2.3 of this section.

B. Valves: UL pattern 175 pound cold water non-shock working pressure rating flanged iron body-bronze trimmed, OS&Y gate type for cut-off, and swing type for check. Check valve shall have ½ inch NPT tapping on inlet side of clapper for ball drip.

2.7 PROTECTIVE ENCLOSURES

A. Description: Manufactured, weather-resistant enclosure designed to protect aboveground water piping equipment or specialties. Include size not less than those required for access and service of protected equipment and the following:
   1. Housing: Reinforced-aluminum construction.
   2. Drain opening.
   3. Access doors with locking devices.
   4. Insulation inside housing.
   5. Electric heater with self-limiting temperature control.
   6. Precast concrete base of dimensions required to extend at least 6 inches (150 mm) beyond edges of housing.
   7. Anchoring devices to attach housing to base.

2.8 FIRE HYDRANTS

A. Fire hydrants shall be Mueller "Centurion" A-423, M & H "Traffic" - Style 129, or approved equal compression type conforming to AWWA Specification C502.

B. Fire hydrants shall be of the lubricated dry top break-away traffic type, each complete with: 5 1/4" minimum valve opening; 6 inch AWWA Specification C111 mechanical joint inlet connection with Plain rubber gasket; 36 inch depth of bury; two National Fire Underwriters Standard 2 1/2" hose connections and one 4 1/2" standard steamer connection; nozzle caps and chains; drain valve; asphalt varnish shop coats inside and below ground outside; and red paint shop coat above ground outside. The following items shall match those of existing hydrants, and the Contractor shall examine the existing hydrants designated by the Owner, obtain necessary data, and furnish new hydrants accordingly:
   1. Sizes of all nozzles.
   2. Threads on all nozzles.
   3. Size and shape of operating and cap nuts.
   4. Direction of rotation of valve opening.

2.9 FIRE DEPARTMENT CONNECTIONS

A. Storz Fire Department Connection: Large single fire department connection furnished with plug and chain, and round escutcheon lettered plate. Storz 1/3 turn quick connect coupling for fire department usage.
   1. Connections: 5" Storz inlet and 6" NPT female outlet.
   2. Finish: Aluminum.
   3. Escutcheon Plate Marking: “AUTO SPKR”.

2.10 BACKFLOW PREVENTERS

A. General: Manufactured backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.

B. Working Pressure: 175 psig minimum, unless otherwise indicated.

C. Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

D. Interior Lining: AWWA C550, epoxy coating for backflow preventers with cast-iron or steel body.

E. Interior Components: corrosion-resistant materials.

F. Additional valve and strainer on inlet.

G. Backflow preventers with notched cam arms will not be accepted.

H. Double-Check-Valve Assembly (Fire Protection): UL 312, FM approved. Assembly has two UL 312, FM-approved, iron body, 175-psig working-pressure, flanged-end check valves, with two UL 262, FM-approved, iron-body, OS&Y, flanged, 175-psig working-pressure gate valves, and strainer on inlet.
   1. Pressure Loss: As scheduled.

I. Double-Check-Valve Assembly (Well Water): UL 1469. Main valve body shall be manufactured from 300 series stainless steel with thermoplastic check valves. Check valves shall have stainless steel hinge pins, cam bearing, and center pivot arm. The complete assembly shall include two independently torsion spring check assemblies, three resilient seated isolation valves, four ball valve type test cocks, and a wye type strainer.

2.11 COMBINATION AIR VALVES

A. Combination air valve sizes 1" through 8", (single body, double orifice) allows large volumes of air to escape out the large orifice when filling a pipeline and closes when liquid enters the valve. When the valve is closed and pressurized, the small air release orifice will open to allow small pockets of air to escape automatically and independently of the large orifice.

B. The large orifice shall also allow large volumes of air to enter during pipeline drainage to break the vacuum. The body inlet must be baffled to protect the float from direct forces of rushing air and water to prevent premature valve shut-off.

C. The Buna-N seat must be fastened to the valve cover without distortion for drop tight shut-off. The floats shall be heavy stainless steel. The plug or float shall be center guided through hex bushings for positive shut-off.

D. Valve exterior to be painted with Universal Metal Primer Paint as accepted by the FDA for use in Potable Water.

E. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

1.	Body and Cover	Cast Iron	ASTM A 126 GR.B
2.	Float	Stainless Steel	ASTM A 240
3.	Needle and Seat	Buna-N	
4.	Plug	Bronze	ASTM B 124
5.	Leverage frame	Delrin/Cast Iron	ASTM D 2133/ASTM A 126 GR.B

F. Valve shall be manufactured by APCO or approved equal.

2.12 ANCHORAGES

A. Clamps, Straps, and Washers: ASTM A 506, steel.

B. Rods: ASTM A 575, steel.

C. Rod Couplings: ASTM A 197, malleable iron.

D. Bolts: ASTM A 2307, steel.

E. Cast-Iron Washers: ASTM A 126, gray iron.

F. Concrete Reaction Backing: Portland cement concrete mix, 3000 psig.
1. Cement: ASTM C 510, Type I.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

2.13 GRANULAR BEDDING

A. Granular pipe bedding material shall be either of the following types:
1. Crushed rock, crushed stone, or washed gravel, 95 percent by weight passing through a 3/4 inch screen, and 95 percent by weight retained on a No. 4 sieve.
2. Sand: clean and sharp.

2.14 GRANULAR BACKFILL

A. Granular backfill material shall be one of the materials specified above for granular pipe bedding material.

B. Usage: Use granular backfill material ONLY where indicated, specified hereinafter, or authorized.

2.15 CONCRETE

A. Concrete shall be 3,000 psi ready mixed type conforming to ASTM Specification C94 composed of Portland cement, sand, and washed coarse aggregate all conforming to ASTM Specifications; mixed with clean water free of oil, acid, alkali, and organic matter; and furnished by an approved ready mix plant's standard for the specified strength, as established and tested by an approved laboratory, in accordance with applicable ASTM Standard Specifications.

PART 3 EXECUTION

3.1 TRENCHING, EXCAVATING, SHORING, BRACING, AND DEWATERING

A. Special Requirements:
1. See RAILROAD CROSSINGS and HIGHWAY CROSSINGS, hereinafter, for special excavation requirements in those areas.
2. See ROCK EXCAVATION AND BLASTING, hereinafter for special excavation requirements where rock is encountered.
3. Driveway and special crossings: install pipe crossing concrete driveways, sidewalks, asphalt driveways, and other special conditions by tunneling or boring, or as authorized. Install pipes crossing dirt or gravel drives by open cut, unless otherwise authorized.
4. Unstable or unsuitable trench bottoms: where authorized because unstable trench bottom conditions, lay pipe on granular bedding, as specified in Article 2.13 GRANULAR BEDDING. Where the trench bottom at required subgrade contains ashes, cinders, any type of refuse, vegetable or other organic material, large pieces or fragments of inorganic material or other unsuitable materials which in the Engineer's opinion should be removed, remove such material; before laying pipe, bring the trench bottom up to proper subgrade by backfilling with approved material placed in three inch maximum thickness loose layers, and thoroughly compact each layer as required to provide an approved firm and stable trench bottom.

B. General Excavation Requirements: Except as otherwise indicated, specified hereinafter, or authorized, make all excavations by open cut as specified in this paragraph. Excavate trenches to the indicated lines and locations to provide uniform and continuous bearing and support of each pipe barrel on firm undisturbed earth at every point between bell holes, with an ample bell hole at each joint to facilitate proper jointing and to prevent bells from bearing on the trench bottom. Trench depths shall be as required to provide the specified MINIMUM cover over the tops of pipes; as required to permit pipes to pass under culverts, railroads, highways, existing pipe lines, and other obstructions; and as required to accommodate valves and boxes. Trench widths shall be as required for the proper laying and jointing of pipes, and the proper placing and compacting of backfill, but in no case shall a trench be more than 24 inches wider than the inside diameter of the pipe to be laid therein. Machine or hand-cut trenches, except that in all cases prepare the final subgrade accurately with hand tools, and in special cases where required, cut the trenches entirely by hand. Where excavation is carried below proper subgrade, before laying pipe bring the trench bottom up to proper subgrade by backfilling with approved material placed in three inch maximum thickness loose layers, and thoroughly compact each layer as required to provide uniform and continuous bearing and support for the pipe barrel at every point between bell holes.

C. Minimum cover over tops of pipes shall be as follows:
1. All pipes, except as otherwise specified below: 30 inch MINIMUM cover.
2. Fire Main: 42 inch minimum cover.
3. Hydrant leads, where they cross side ditches ONLY: 18 inch MINIMUM cover.
4. Hydrant leads, all other locations: 42 inches MINIMUM cover.

5. Special Conditions: MINIMUM cover as indicated on the drawings.

D. IN ALL CASES, THE SPECIFIED MINIMUM COVER OVER PIPES SHALL BE BASED UPON FINAL FINISHED SURFACES, INCLUDING PAVING, IF ANY. Where grading is involved, do not cut trenches under roads, streets, or other areas until the final finish grading has been done, unless otherwise authorized.

E. Shore and brace trenches and excavations as required, to protect personnel, adjacent structures, and adjacent property. Where required by the conditions encountered, brace trenches and excavations with suitable close sheeting or sheet piling. Do all necessary cribbing up required for the proper operation of trenching machines.

F. Provide and maintain in proper working order all necessary dewatering equipment required to remove water from the excavations. Where quicksand or other water bearing strata are encountered, install and connect the necessary number of well points with pumping equipment of sufficient capacity to prevent rise of water in the excavation until the work has been installed properly and will be unaffected by submersion.

G. Do not install any work until excavations are free of water, mud, and loose earth. Do not install any work on frozen ground.

3.2 ROCK EXCAVATION AND BLASTING

A. Wherever used as the name of an excavated material, the term "rock" shall mean any one or more of the following materials which in the Engineer's opinion require for their removal drilling and blasting, wedging, sledging, or barring, or breaking up with power operated hand tools: boulders, pieces of concrete, and pieces of masonry, each weighing more than 250 pounds; and solid ledge rock, concrete, and masonry, each with more than ½ cubic yard of volume. No measurement or allowance will be made for: soft or disintegrated rock or gravel which can be removed with a hand pick or power operated excavator or shovel; loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere; rock exterior to the limits of measurement allowed which may fall into the excavation; and removal of existing pavement.

B. Where rock is encountered in pipe trenches, remove all rock from sides of trench to provide at least six inch horizontal clearance from the pipe bells on each side, and remove all rock from required subgrade down to at least four inches below the bottom of the pipe bells. Bring trench bottom up to required subgrade by backfilling with one of the following materials placed and compacted as required to provide uniform and continuous bearing of pipe barrels at every point between bell holes; sand; selected earth as specified in 3.11 BACKFILLING hereinafter; or granular bedding material in Article 2.13 GRANULAR BEDDING, as specified hereinbefore.

C. Where blasting is required, conduct all blasting operations only with properly qualified personnel in accordance with all applicable ordinances and regulations. Cover all blasts with suitable blasting mats, and use all other safety precautions as required to prevent personal injury and property damage. Repair all damage caused by blasting operations.

3.3 HANDLING AND LAYING DUCTILE IRON FITTINGS

A. Provide and use suitable equipment for the safe and convenient handling of fittings, valves, and other water piping materials. Unload all materials carefully, and lower them carefully into the trenches, piece by piece, in such a manner that will prevent damage to the materials and their protective coatings and linings. Do not under any circumstances drop or dump water piping materials, either from transportation vehicles, or into trenches.

B. Before laying, inspect each fitting for defects. Promptly remove all defective fittings from the pipe laying area.

C. Before laying pipe and fittings: Remove all lumps, blisters, and excess coal tar coating from each spigot and the inside of each bell; wire brush and wipe all dirt and other foreign matter from the outside of each spigot and the inside of each bell; swab out the inside of each length of pipe and each fitting; and remove all dirt and other foreign matter from all gaskets, glands, bolts, and nuts. Use every precaution to prevent dirt and other foreign matter from entering fittings while they are being laid. Spigot ends, insides of bells, gasket grooves, gaskets, glands, bolts, and nuts shall be kept free from dirt and other foreign matter after they have been cleaned and before the joints have been made up.

D. Mechanical Joints: After placing pipe and fittings into the trench, slide gland over spigot, apply proper lubricant to gasket and spigot, slip gasket over spigot, center spigot end in bell, force pipe home, and bring it into correct line and grade. Press gasket evenly in place into bell, slide gland into position for bolting, insert all bolts, screw on and hand tighten all nuts, then tighten all nuts with an approved wrench. Tighten diagonally opposite nuts alternately to obtain uniform pressure on all parts of the gland, with torques of 40 to 60 foot pounds for 5/8 inch bolts, and 60 to 90 foot pounds for 3/4 inch bolts. Realign pipe as required and secure it in place with approved backfill material tamped around pipe, except at bells.
   1. On retainer type glands, after pipe has been aligned properly, tighten all set screws as specified hereinafter under ANCHORAGE.

E. Do not "buckle-in" any pipe without approval.

F. At all times when pipe laying is not in progress, keep all open ends closed tightly with suitable caps or plugs to prevent foreign material from entering any part of the pipework.

3.4 HANDLING AND LAYING PVC PIPE AND FITTINGS

A. Provide and use suitable equipment for the safe and convenient handling of pipe, fittings, valves, and other water piping materials. Unload all water piping materials carefully, and lower them carefully into the trenches, piece by piece, in such a manner that will prevent damage to the materials. Do not under any circumstances drop or dump piping materials, either from transportation vehicles, or into trenches.

B. Generally, handle and lay PVC pipe and PVC fittings in accordance with the manufacturer's printed instructions. Obtain these instructions, read them thoroughly, and keep at least one copy thereof on the job at all times in good condition, for Contractor's and Engineer's use.

C. Lay PVC mains with joints and fittings in good alignment and arranged to allow for free expansion and contraction of piping without causing excessive stress on piping. DO NOT "SNAKE" PIPE INTO TRENCHES.

D. Before Laying Pipe and Fittings: Inspect each length of pipe and each fitting for defects, and promptly remove all defective pipe and fittings from the pipe laying area; remove all dirt and other foreign matter from the insides of the pipe and fittings, spigot ends, insides of bells, gasket grooves, and gaskets; and swab out each length of pipe (except service lines). Use every precaution to prevent dirt and other foreign matter from entering the pipe and fittings while they are being laid. Spigot ends, insides of bells, gasket grooves, and gaskets shall be kept free of dirt and other foreign matter after they have been cleaned and before the joints have been made up.

E. Rubber Ring Joints: After placing pipe and fittings into trench: insert gasket in groove in bell; lubricate spigot end with lubricant supplied by the pipe manufacturer; push spigot end into bell until depth indicating stripe on spigot is covered by bell; then finally pull pipe out until the stripe on the spigot end reappears in line with the outer end of the bell, to allow for free expansion of piping.

F. Make all field cuts and bevel all field cut ends with special tools as recommended by the piping manufacturer.

G. At all times when pipe laying is not in progress, keep all open ends closed tightly with suitable caps or plugs to prevent foreign material from entering any part of the pipework.

3.5 ALIGNMENT OF PIPE

A. Ductile Iron Pipe: In straight trenches, lay pipe in reasonably straight lines, using appropriate fittings at all sharp breaks in grade. In curved trenches, lay pipe to follow the trench centerline as closely as practicable, using appropriate fittings at all sharp breaks in grade, and using appropriate fittings or deflecting joints and using shorter than standard lengths of pipe as necessary to make the required curves. Do not deflect any joint in excess of pipe manufacturer's recommendations.

B. PVC Pipe: In straight trenches, lay pipe in reasonably straight lines, using appropriate fittings at all sharp breaks in grade. In curved trenches, lay pipe to follow the trench centerline as closely as practicable, using appropriate fittings at all sharp breaks in grade, and using appropriate fittings or bending the pipe in gradual uniform curves in accordance with AWWA M23 to make the required curves. Do not bend any pipe with a radius of curvature less than that recommended by the pipe manufacturer.

3.6 ANCHORAGE

A. Provide anchorage for each fire hydrant, and for each bend, tee, plug, dead-end, and other fitting subject to blowing off of the line under pressure in accordance with NFPA 24.

B. Unless otherwise indicated, anchorage shall consist of 3,000 psi concrete blocking poured between firm undisturbed earth and the unbalanced sides of the items to be anchored, with sufficient earth bearing area to prevent displacement of joints under pressure. Pour concrete blocking before applying pressure test on piping and arrange it so that the pipe and fitting joints will be accessible for repair. BLOCKING BEARING AREA SHALL BE BASED UPON THE SPECIFIED TESTING PRESSURE.

C. Retainer Glands: These shall be ductile iron mechanical joint set-screw type, installed in accordance with manufacturer's directions, with set screws tightened uniformly to about 80 foot pounds torque. This type of anchorage MAY be used at any location instead of concrete anchorage subject to approval, and SHALL be used at the following locations:
   1. Where indicated.
   2. Where concrete anchorage is not practicable.

D. Anchoring Type Tees for Fire Hydrant Connections: These shall be as specified hereinbefore under: DUCTILE IRON PIPE, FITTINGS, AND JOINTS; and/or PVC PIPE, FITTINGS, AND JOINTS. Anchor fire hydrant cut-off valves directly to the locked-on gland rings of the tee outlets.

3.7 VALVE AND BOX INSTALLATION

A. Install valves with their operating stems plumb, at approximate locations indicated, but at exact locations as approved and as specified below. Leave all valves in normal operating positions, free from leakage.
   1. Fire hydrant cut-off valves: install these directly on the spigot outlets of the anchoring type tees in the mains.
   2. All other valves: insofar as practicable, install these 3'-0" from centers of tees and crosses at intersections, and at locations in runs where easy to find in the future. Set each valve box in a concrete slab 36" square and 6" thick, flush with finished grade.

B. Set and support each valve box so that no stress or shock can be transmitted to the valve, with the box centered and plumb over the valve wrench nut, and the box top exposed and flush with finished grade. Readjust boxes as required so that all boxes conform to these requirements at the time of acceptance of the system.

C. Valves and Stub-out Pipes for Future Connections to Water Mains:
   1. Anchor these valves to the mains as specified hereinafter under ANCHORAGE.
   2. Where NO piping is indicated from valve outlet: plug each valve outlet with a standard cast iron plug. Do not anchor or block plug.
   3. Where stub-out is indicated from valve outlet: close the open end of each stub-out pipe with a suitably easily removable plug which will prevent dirt from entering the stub-out pipe, but will allow water to escape from the stub-out pipe and prevent water pressure therein if the valve should leak or be opened before the future piping is properly connected to the stub-out pipe. Do not anchor or block stub-out piping on outlet sides of these valves.

3.8 HYDRANT INSTALLATION

A. Install hydrants at approximate locations indicated, but at exact locations as approved. Unless otherwise indicated or approved, locate hydrants at the intersections of private property lines, and between curbs and sidewalks. All hydrant leads shall be six inch pipe.

B. Set each hydrant on a four inch thick 15 inch square minimum size precast concrete slab in true plumb position, with lowest nozzle at least 12 inches above finished grade. Securely block or anchor hydrant to prevent it from blowing off of lead, and place at least 1/4 cubic yard of broken stone or coarse gravel around the base to at least 12 inches above and 12 inches below the drain hole for proper drainage.

C. Hydrant Extensions: Provide hydrant extension units in the lump sum bid, only where authorized for satisfactory hydrant settings under abnormal or adverse job conditions beyond the Contractor's control. No payment will be made for any hydrant extension units which may be required as a result of Contractor's errors or negligence, and all such hydrant extensions necessary for satisfactory hydrant settings in all such cases shall be provided by the Contractor at his own expense, as required. Otherwise, install hydrants with the specified bury. All hydrant settings, regardless of length, shall conform to all of the above specified setting requirements.

D. After setting, and after testing and final cleanup of the work, finish paint each hydrant above ground line with one coat of highest quality outside paint, color as selected by the Engineer.

3.9 BACKFLOW PREVENTER AND COMBINATION AIR VALVE INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to plumbing and health department authorities having jurisdiction.

B. Do not install bypass around backflow preventer.

C. Support backflow preventers, valves, and piping on brick or concrete piers.

3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated.

B. Install ball drip valves at each check valve for fire department connection to mains.

3.11 BACKFILLING

A. General:
   1. Do not backfill pipe trenches until the pipework has been inspected and approved. Immediately after approval, backfill the trenches as specified below.
   2. Testing for leaks on the surface of the pipe prior to backfilling will not be required, but other test procedures, as specified hereinafter under TESTING, shall be followed after backfilling trenches.

B. Pipe Under Non-Paved Areas: Backfill the trenches with the materials specified below. Up to six inches ABOVE tops of pipes and BEFORE placing remaining backfill, thoroughly hand tamp the backfill equally and uniformly into bell holes and between trench walls and pipework on each side of the pipework, and over the tops of the pipework, all to prevent pipe displacement. Then place the remaining backfill to fill the trenches completely, and compact the backfill by running the wheels of heavy rubber-tired construction equipment longitudinally over the trench, until the backfill is compacted to at least the density of the undisturbed soil and is flush with the surrounding ground surfaces. Finally, windrow the excess excavated materials over the trench. At the end of each day's work, do not leave more than 200 feet of trench without compacted backfill, unless otherwise approved. PUDDLING OR WATER JETTING WILL NOT BE PERMITTED.

C. Pipe Under Paved Areas, Including Areas with Existing Paving and Areas Proposed to be Paved: Backfill the trenches with sand ONLY, from pipe laying subgrade up to paving subgrade. Up to tops of pipes and BEFORE placing the remaining backfill, place and compact sand backfill equally and uniformly into bell holes and between the trench walls and pipework on each side of the pipework, all to prevent pipe displacement. Then place the remaining sand backfill to fill the trenches completely up to paving subgrade. For each section of pipe laid, do not allow more than 200 feet of trench to remain without compacted backfill at the end of the day on which the section of pipe was laid, unless otherwise approved.

D. Vehicular Traffic: For all pipes crossing streets, roads, gravel driveways, and dirt driveways which are in regular use, backfill the trenches and make the crossings usable by vehicular traffic immediately after laying pipe and obtaining approval thereof, and maintain these crossings usable by vehicular traffic until project acceptance. Do not under any circumstances leave a street or road crossing or a private driveway unusable overnight.

E. Backfill Materials, Except as Otherwise Specified:
   1. Up to six inches above the tops of the pipes: backfill only with selected earth which is free of rocks, stones, bricks, cinders, broken concrete, rubbish, wood, vegetable materials, topsoil, and other unsuitable materials.
   2. From six inches above tops of pipes up to finished grade or paving subgrade as the case may be: backfill with any materials removed from the excavation and suitable for backfill, except do not use as backfill material any pieces of the following materials which are larger than six inches in their greatest dimensions: rock; stone; concrete; asphalt paving; or masonry. Dispose of all excavated materials which are not replaced as backfill, as approved.

F. Final Backfilling Requirements: Refill and smooth off as required all backfill which settles, so that all backfill finally conforms to the original ground surfaces, not only at the time of project acceptance, but also for the duration of the guarantee period. This includes removing and repairing all pavement which may have been damaged by settlement.

G. Special Backfill Requirements:
   1. Pipes in tunneled or bored holes, without casings: backfill with sand only, placed as approved and as required to prevent caving and settling.
   2. See HIGHWAY CROSSINGS and RAILROAD CROSSINGS, hereinafter for special backfill requirements.

3. Granular backfill materials: where authorized in the field to accommodate special conditions which may be encountered, where indicated on drawings, and/or where specified herein, backfill materials from six inches above tops of pipes up to finished grade or paving subgrade as the case may be, shall be as specified in Article 2.13 GRANULAR BACKFILL.

3.12 CONNECTIONS TO EXISTING WATER SYSTEM

A. "Pressure" Connections: Where indicated or authorized, make the connection to existing water main by installing therein a split mechanical joint tapping sleeve and tapping valve, and cutting proper opening in existing main with a suitable tapping machine, all without shutting off water in existing main involved. Tapping valves and their boxes shall conform in all respects to applicable requirements of CUT-OFF VALVES AND VALVE BOXES hereinbefore, and tapping valves shall be one gate type, each with one flanged end to mate with tapping sleeve flange, and one mechanical joint hub end. All connections to existing water mains shall be per Local Utility requirements.

3.13 TESTING

A. After backfilling, subject all pipework to pressure and leakage tests. Piping may be tested in sections between valves as the work progresses. Admit water slowly into the section to be tested, and expel all air through all hydrants, and through corporation stops or other openings at all high points in the piping, as required. After all air has been expelled apply a hydrostatic pressure of 200 psi measured at the lowest point in the piping section involved. Maintain the test pressure at least two hours, during which time the leakage shall not exceed that permitted by AWWA Specification C600 for mechanical joint and push-on joint pipe. Repair all apparent leaks. If the measured leakage exceeds the maximum specified allowable leakage locate and repair the leaks, and repeat the tests on sections of pipe involved until all tests have been approved. Furnish approved testing equipment, consisting of a suitable pump to apply and maintain test pressure, accurate pressure gauges, suitable equipment to measure volume of water pumped, and other necessary equipment, and conduct all tests in the Engineer's presence, as approved. Determine leakage by measuring the volume of water pumped to maintain the required test pressure for the duration of the leakage test. Obtain a copy of AWWA Specification C600, and keep it on the job in good condition for the Contractor's and Engineer's use in computing the permissible leakage in each section to be tested.

3.14 DISINFECTION

A. Disinfect the water lines in accordance with Section 33 13 00 "Disinfection of Water Distribution System".

B. After all tests have been approved, and before placing the pipe lines in service, sterilize all new pipework with chlorine for at least 24 hours duration. Introduce sufficient chlorine into pipe line to provide at least 50 ppm chlorine residual throughout the entire piping system, using either liquid chlorine or chlorine bearing compounds similar to "HTH", and determining the required quantity of chlorinating agent in accordance with the manufacturer's directions for the calculated volume of water to be treated. Inject chlorine solution into the pipe lines through corporation stops installed at proper locations in pipe line, or through other openings. After at least 24 hours retention time, thoroughly flush all chlorinated water out of the pipe lines through hydrants and other openings, take samples of the fresh water at approved locations in the pipe line, and have the samples analyzed for bacterial purity by an approved laboratory. Continue this process until the samples indicate that the water is free of contamination and safe for domestic use, all to the satisfaction of the Engineer and the Department or Board of Public Health of the State in which the work is located. Furnish all necessary approved sterilizing equipment and chlorinating agents. The Contractor shall pay for all laboratory bacterial analysis services, and include the cost thereof in the contract price.

C. Water for testing, sterilizing, and flushing will be furnished by the Owner from existing water facilities, without cost to the Contractor, but the Contractor shall furnish all piping and equipment to convey the water to the new pipe lines.

3.15 CUTTING AND REPLACING PAVEMENT AND OTHER SPECIAL SURFACES

A. Restore to at least the conditions which existed before excavation, all surfaces which have been disturbed by the pipeline installation, as specified below. As each surface is being cut, the Engineer will examine the existing surface in the Contractor's presence, and the type of surface to be replaced in each case shall be determined by mutual agreement between the Engineer and the Contractor.

B. As specified under TRENCHING, EXCAVATION, SHORING, BRACING, AND DEWATERING, the maximum pipe trench width shall be 24 inches greater than the inside diameter of the pipe laid therein. The maximum width of all pavement and other surface repairs allowable for payment by the Owner will be the inside diameter of the pipe plus 36 inches, or six inches beyond each side of the maximum allowable trench width. At Contractor's expense, make all repairs outside of this limit. If the repairs do not reach this limit, the Owner will pay ONLY for the actual extent of the repairs.

C. Prior to making any excavation, outline the limits of the proposed excavation, and saw-cut the pavement along the outline to a depth of at least one inch to provide a smooth pavement cut line. Carefully remove the pavement between the saw-cuts and avoid damage to the paved surface outside the saw-cuts. Replace with new surfaces all existing surfaces which are cut, removed, or otherwise damaged by the work under this Contract, as specified below. All new surfaces shall conform accurately to the elevations and contours of the existing adjacent undisturbed surfaces.

D. Repair damaged pavement and special surfaces as follows:
   1. Existing gravel surfaces: replace these with a six inch thick compacted layer of new road gravel.
   2. Concrete Surfaces: replace these with 3000 psi concrete, 6" thick for streets, and 4" thick for aprons, driveways, and sidewalks.
   3. Existing Asphalt ("black top", single bituminous surfaces and double bituminous surfaces): replace these with at least 15" thick compacted base course of crushed limestone (CR 610) conforming to Mississippi Standard Specifications for Road and Bridge Construction, which shall be watered and compacted for consolidation. The 15" base course shall be considered as a temporary traffic surface and shall be maintained in good condition until paved. Maintenance shall include, filling pot holes, work necessary to confine stone to trench area by sweeping with mechanical sweeper with collection hopper and water-fed brooms, and watering temporary surface daily, if necessary, for dust control. To avoid mixture of earth backfill and limestone base, all excess excavated material shall be removed from the work area prior to placing of the limestone base. Permanent pavement to consist of two (2) inches of Hot Bituminous Pavement Surface Course Type SC-1, Mississippi Standard Specification for Road and Bridge Construction or as specified on the plans. Before laying asphaltic concrete surface course, apply a prime coat to the underlying base course, as specified in paragraph (4). When authorized by the Engineer, the contractor shall proceed immediately with the application of the permanent (HPM), Asphaltic Concrete Surfacing. Not having sufficient areas to warrant moving paving Subcontractor to site will not be acceptable as reason for delaying paving when there is as much as one block or 600 feet of trench ready for permanent paving.
      a. Failure by the Contractor to proceed with the performance of this phase of the work immediately after above authorization, may be considered cause for deducting the section of pipe line from the periodic estimate.
   4. Temporary Pavement: Where authorized by the Engineer in the field, the Contractor shall immediately provide temporary pavement over the crushed limestone base as specified in Paragraph 3 above. The temporary pavement over the pipe line trench shall

be a 1" thick approved, plant mixed, bituminous pavement rolled to conform to existing surrounding street surfaces. The temporary pavement shall be allowed to settle under traffic for a time period determined by the Engineer, after which the temporary pavement shall be removed and replaced by permanent pavement as specified in Article 3.15 hereinbefore. The length of pipeline trenches along or across paved streets, which are to be temporarily paved as above, shall not exceed one block or 600 feet at any one time on any single street or road.

5. Prime coat: this shall be one of the following types of liquid asphalt as authorized for the conditions involved: RC-70; RC-250; MC-70; or MC-250. Heat the priming material and apply it with a suitable asphalt distributor, at a uniform rate of 0.25 to 0.50 gallons per square yard of base, all as approved.

E. Where pipe is installed on the shoulders parallel to asphalt, double bituminous surface treatment, concrete, or other surfaces, maintain ditches until they are firm and present no traffic hazard. Where authorized, place six inch thick compacted layers of new road gravel.

F. Do not cut streets, roads, and other paved surfaces except where necessary for the water main installation. At Contractor's expense, repair all damage outside of the specified limits, as approved. Maintain all crossings until project completion.

G. Concrete Curbs and Gutters: Replaced with new cast-in-place concrete all existing curbs and gutters which have been removed to accommodate the piping installation. New curbs and gutters shall match the existing undisturbed curbs and gutters in cross section and finish. Concrete shall be 3000 psi type. Before placing concrete, compact subgrade as specified in paragraph 3.11 hereinbefore.

H. Road Gravel Material: Road gravel shall be of the same type and gradation as that used for street and road work by the local street or County road department in the area in which the water system is located.

I. County Approvals: All repairs to County roads shall be subject to the approval of each County road department involved. FINAL PAYMENT WILL NOT BE MADE UNTIL THE CONTRACTOR HAS OBTAINED ALL NECESSARY COUNTY ROAD DEPARTMENT APPROVALS AND SUBMITTED ACCEPTABLE WRITTEN EVIDENCE THEREOF.

3.16 CLEANING UP OF DISTRIBUTION SYSTEM

A. Clean up the distribution system as the work progresses. Negligence in proper cleaning up which causes undue inconvenience to the public or private citizens, or presents an unsightly or dangerous condition, or causes embarrassment to civic officials will be sufficient reason for rejection of construction estimates until the unsatisfactory conditions have been remedied.

B. After all work is complete, make a final cleanup of all areas where work has been done, and leave them in broom clean condition.

3.17 FINAL VALVE AND HYDRANT CHECK

A. After completion of all water line work and before the work will be accepted, make a final check of each valve and hydrant installed in this project, and of each existing valve that has been operated in connection with the work under this project.

B. Make this final check in the Engineer's presence, and demonstrate that each valve is in fully open position, and that each hydrant operates properly. Seal all valves in the open position after final inspection.

3.18 SEPARATION OF WATER MAINS AND EXISTING SEWERS

A. Parallel Installation:
   1. Normal conditions: water mains shall be laid at least 10 feet horizontally from existing sanitary sewers, storm sewers, and sewer manholes, wherever possible; the distance shall be measured edge-to-edge.
   2. Unusual conditions: where local conditions prevent a 10 foot horizontal separation, a water main may be laid closer to existing storm or sanitary sewers, provided that the bottom of the water main is at least 18 inches above the top of the existing sewer.

B. Crossings:
   1. Normal conditions: water mains crossing existing house sewers, storm sewers, or sanitary sewers shall be laid above said sewers and shall provide a separation of at least 18 inches between the bottom of the water main and the top of the existing sewer, wherever possible.
   2. Unusual conditions: where local conditions prevent a vertical separation as described above, water mains passing under existing sewers shall be protected by providing:
      a. A vertical separation of at least 18 inches between the bottom of the existing sewer and the top of the water main.
      b. Adequate structural support for the existing sewers, to prevent excessive deflection of joints and settling on and breaking the water mains.
      c. A full laying length of water pipe centered at the point of crossing, so that the joints will be equidistant and as far as possible from the existing sewer.

C. Manholes: No water pipe shall pass through or come into contact with any part of any existing manhole.

3.19 METERS

A. Water meter shall be installed by separate project. Coordinate with the local utility water department for water meter.

END OF SECTION

SECTION 33 1300

DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection of potable water distribution and transmission system.

B. Testing and reporting results.

1.2 REFERENCES

A. ANSI/AWWA B300 - Standard for Hypochlorites.

B. ANSI/AWWA B301 - Standard for Liquid Chlorine.

C. ANSI/AWWA B303 - Standard for Sodium Chlorite.

D. ANSI/AWWA C651 - Standards for Disinfecting Water Mains.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Test Reports: Indicate results comparative to specified requirements.

C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

1.4 PROJECT RECORD DOCUMENTS

A. Disinfection report; record:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   5. Date and time of flushing start and completion.
   6. Disinfectant residual after flushing in ppm for each outlet tested.

B. Bacteriological report; record:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24 hour disinfectant residuals in ppm for each outlet used.
   6. Coliform bacteria test results for each outlet tested.
   7. Certification that water conforms, or fails to conform, to bacterial standards of the state.
   8. Bacteriologist's signature and authority.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI/AWWA C651.

1.6 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum three years experience.

B. Testing Firm: Company specializing in examining potable water systems, approved by the State of Mississippi.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code or regulation for performing the work of this section.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: ANSI/AWWA B300, Hypochlorite, ANSI/AWWA B301, Liquid Chlorine, and ANSI/AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping system has been cleaned, inspected and pressure tested.

B. Perform scheduling and disinfection activity with startup, testing, adjusting and balancing, demonstrating procedures, including coordination with related systems.

3.2 EXECUTION

A. Provide and attach required equipment to perform the work of this Section.

B. Inject treatment disinfectant into piping system.

C. Maintain disinfectant in system for 24 hours.

D. Flush, circulate and clean until required cleanliness is achieved; use municipal domestic water.

3.3 QUALITY CONTROL

A. Provide analysis and testing of treated water under provisions of Division 01.

B. Test samples in accordance with ANSI/AWWA C651.

END OF SECTION