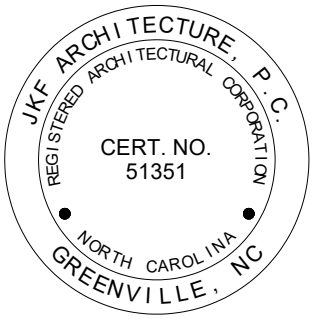
PROJECT MANUAL

BEAUFORT COUNTY COMMUNITY COLLEGE
NEW SKILLS BUILDING
WASHINGTON, NC

SCO #24-28654-01A

JKF Project No. 2024-17
August 15, 2026



Specification No.

JKF ARCHITECTURE

625 Lynndale Ct. Suite F
Greenville, NC 27858
252-355-1068 Phone
252-355-0216 Fax
jkf@jkf-arch.com

ADVERTISEMENT FOR BIDS

Sealed proposals will be received from Bidders by Beaufort County Community College, 5337 US Hwy. 264 East, Washington, NC 27889, attn: Ms. Laura Kelly, Director of Campus Operations, in Building #1 Conference Room 103, up to 3:00 PM Thursday, October 29, 2026, and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment entering into the construction of:

Beaufort County Community College
New Skills Building
SCO ID# 24-28654-01A

Pre-Bid Meeting; Wednesday, October 7, 2026 at 10:00 AM at Beaufort County Community College, Building #1 Conference Room 103.

Alternate Bid No. 1; Preferred Alternate; Firelite Fire Alarm System.

Alternate Bid No. 2; Preferred Alternate; Door Hardware- Corbin-Russwin where specified as Basis for Design.

Complete plans and specifications for this project can be obtained at JKF ARCHITECTURE, 625 Lynndale Ct., Suite F, Greenville, NC 27858, during normal office hours after September 7, 2026.

Plans and specifications available for viewing at Dodge Data & Analytics, ConstructConnect, The Blue Book Plan Room, and Duncan Parnell-Greenville, NC.

Plan Deposit: $200 for hard copy Bid Package & PDF's. No cost PDF's for GC who register with Architect.

The state reserves the unqualified right to reject any and all proposals.

Signed:
Ms. Laura Kelly, Director of Campus Operations
Beaufort County Community College
5337 US Hwy. 264 East
Washington, NC 27889

TABLE OF CONTENTS

BEAUFORT COUNTY COMMUNITY COLLEGE
NEW SKILLS BUILDING
SCO ID# 24-28654-01A

BIDDING REQUIREMENTS

- NOTICE TO BIDDERS (2 PAGES)
- INSTRUCTION TO BIDDERS AND GENERAL CONDITIONS OF THE CONTRACT – STANDARD FORM FOR CONSTRUCTION PROJECTS (45 PAGES)
- SUPPLEMENTARY GENERAL CONDITIONS (2 PAGES)
- STATEMENT OF SPECIAL INSPECTIONS (30 PAGES)

Division	Section Title	Pages
DIVISION 01 - GENERAL REQUIREMENTS		
011000	SUMMARY	4
012100	ALLOWANCES	2
012200	UNIT PRICES	2
012300	ALTERNATES	2
012500	SUBSTITUTION PROCEDURES	3
012600	CONTRACT MODIFICATION PROCEDURES	2
012900	PAYMENT PROCEDURES	3
013100	PROJECT MANAGEMENT AND COORDINATION	7
013200	CONSTRUCTION PROGRESS DOCUMENTATION	5
013300	SUBMITTAL PROCEDURES	10
014000	QUALITY REQUIREMENTS	9
015000	TEMPORARY FACILITIES AND CONTROLS	9
016000	PRODUCT REQUIREMENTS	5
017300	EXECUTION	7
017700	CLOSEOUT PROCEDURES	5
017823	OPERATION AND MAINTENANCE DATA	4
017839	PROJECT RECORD DOCUMENTS	3
017900	DEMONSTRATION AND TRAINING	5
DIVISION 02 - EXISTING CONDITIONS- NOT USED		
DIVISION 03 - CONCRETE		
033000	CAST-IN-PLACE CONCRETE	13
DIVISION 04 - MASONRY		
042000	UNIT MASONRY	19
DIVISION 05 - METALS		
051200	STRUCTURAL STEEL FRAMING	7
052100	STEEL JOIST FRAMING	4
053100	STEEL DECKING	4
054000	COLD-FORMED METAL FRAMING	6
055000	METAL FABRICATIONS	7

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
061000 ..... ROUGH CARPENTRY 4
061600 ..... SHEATHING 3
064116 ..... PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS 4

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
071113 ..... BITUMINOUS DAMPPROOFING 3
072100 ..... THERMAL INSULATION 4
072500 ..... WEATHER BARRIERS 2
074113 ..... STANDING-SEAM METAL ROOF PANELS 12
074213 ..... FORMED METAL WALL PANELS 9
074293 ..... METAL SOFFIT PANELS 7
077253 ..... SNOW GUARDS 2
079200 ..... JOINT SEALANTS 8

DIVISION 08 – OPENINGS
081113 ..... HOLLOW METAL DOORS AND FRAMES 5
081213 ..... HOLLOW METAL FRAMES 6
081416 ..... FLUSH WOOD DOORS 5
083323 ..... OVERHEAD COILING DOORS 9
084113 ..... ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS 10
085113 ..... ALUMINUM WINDOWS 6
087100 ..... DOOR HARDWARE 12
088000 ..... GLAZING 9
088300 ..... MIRRORS 4
089119 ..... FIXED LOUVERS 5

DIVISION 09 – FINISHES
092216 ..... NON-STRUCTURAL METAL FRAMING 6
092900 ..... GYPSUM BOARD 7
093013 ..... CERAMIC TILING 9
095113 ..... ACOUSTICAL PANEL CEILINGS 6
096513 ..... RESILIENT BASE AND ACCESSORIES 4
096519 ..... RESILIENT TILE FLORRING 5
099113 ..... EXTERIOR PAINTING 5
099123 ..... INTERIOR PAINTING 7
099600 ..... HIGH PERFORMANCE COATINGS 6

DIVISION 10 – SPECIALTIES
101100 ..... VISUAL DISPLAYS 4
101423 ..... PANEL SIGNAGE 5
102113 ..... PLASTIC TOILET COMPARTMENTS 4
102800 ..... TOILET, BATH, AND LAUNDRY ACCESSORIES 4
104413 ..... FIRE PROTECTION CABINETS 3
104416 ..... FIRE EXTINGUISHERS 2
105300 ..... ALUMINUM CANOPY 2

DIVISION 12 – FURNISHINGS

123661 ..... SIMULATED STONE COUNTERTOPS 2

DIVISION 22 – PLUMBING

SEE TABLE OF CONTENTS FROM ATLANTEC ENGINEERS

DIVISION 23 – HVAC

SEE TABLE OF CONTENTS FROM ATLANTEC ENGINEERS

DIVISION 26- 28 – ELECTRICAL, COMMUNICATION, & FIRE ALARM

SEE TABLE OF CONTENTS FROM ATLANTEC ENGINEERS

DIVISION 31 – EARTHWORK.

311000 ..... SITE CLEARING 3
312000 ..... EARTH MOVING 4
313116 ..... TERMITE CONTROL 3

DIVISION 32 – EXTERIOR IMPROVEMENTS.

321216 ..... ASPHALT PAVING 4
321313 ..... CONCRETE PAVING 4
321723 ..... PAVEMENT MARKINGS 2

BID FORMS

- SECTION 305- FORM OF PROPOSAL
- FORM OF BID BOND
- FORM OF CONSTRUCTION CONTRACT
- FORM OF PERFORMANCE BOND
- FORM OF PAYMENT BOND
- SHEET FOR ATTACHING POWER OF ATTORNEY
- SHEET FOR ATTACHING CERTIFICATE OF INSURANCE
- STATE OF NORTH CAROLINA COUNTY SALES AND USE TAX REPORT
- SECTION 309- APPROVAL OF THE ATTORNEY GENERAL

For Structural

END OF TABLE OF CONTENTS

N O T I C E T O B I D D E R S

Sealed proposals will be received from Bidders by Beaufort County Community College, 5337 US Hwy. 264 East, Washington, NC 27889, attn: Ms. Laura Kelly, Director of Campus Operations, in Building #1 Conference Room 103, up to 3:00 PM Thursday, October 29, 2026, and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment entering into the construction of:

Beaufort County Community College
New Skills Building
SCO ID# 24-28654-01A

Bids will be received for Contract type – (single prime): Category-General. All proposals shall be lump sum.

Pre-Bid Meeting

An open pre-bid meeting will be held for all bidders and all interested vendors on Wednesday, October 7, 2026 at 10:00 AM at Beaufort County Community College, Building #1 Conference Room 103. The meeting will address project specific questions, issues, bidding procedures and bid forms.

The meeting is also to identify preferred brand alternates and their performance standards that the owner will consider for approval on this project.

In accordance with General Statute GS 133-3, Specifications may list one or more preferred brands as an alternate to the base bid in limited circumstances. Specifications containing a preferred brand alternate under this section must identify the performance standards that support the preference. Performance standards for the preference must be approved in advance by the owner in an open meeting. Any alternate approved by the owner shall be approved only where (i) the preferred alternate will provide cost savings, maintain or improve the functioning of any process or system affected by the preferred item or items, or both, and (ii) a justification identifying these criteria is made available in writing to the public.

In accordance with GS133-3 and SCO procedures the following preferred brand items are being considered as Alternates by the owner for this project:

A. Preferred Alternate; Fire-lite Fire Alarm System

B. Door Hardware- Corbin-Russwin where specified as Basis for Design

Justification of any approvals will be made available to the public in writing no later than seven (7) days prior to bid date.

Complete plans, specifications and contract documents will be open for inspection in the offices of Sammy Deans at Beaufort County Community College, and **JKF Architecture PC**, and in the plan rooms of Dodge Data & Analytics, Construct Connect, The Blue Book Plan Room, and Duncan-Parnell Greenville NC. or may be obtained by prime bidders, upon deposit of $200 in cash or certified check. The full plan deposit will be returned to those bidders provided all documents are returned in good, usable condition within ten (10) days after the bid date. PDF sets only will be made available to all prime bidders at no cost provided they register with the Office of the Architect.

All contractors are hereby notified that they must have a proper license as required under the state laws governing their respective trades.

General contractors are notified that Chapter 87, Article 1, General Statutes of North Carolina, will be observed in receiving and awarding general contracts. General contractors submitting bids on this project must have license classification for Building Contractor-Unlimited

Under GS 87-1, a contractor that superintends or manages construction of any building, highway, public utility, grading, structure or improvement shall be deemed a “general contractor” and shall be so licensed. Therefore, a single prime project that involves other trades will require the single prime contractor to hold a proper General Contractors license.

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five

percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the bid bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

A performance bond and a payment bond will be required for one hundred percent (100%) of the contract price.

Payment will be made based on ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 60 days.

The owner reserves the right to reject any or all bids and to waive informalities.

Designer:

JKF Architecture PC
625 Lynndale Ct.
Suite F
Greenville, NC 27858
252-355-1068
jkf@jkf-arch.com

Owner:

Ms. Laura Kelly, Director of Campus Operations
Beaufort County Community College
5337 US Hwy. 264 East
Washington, NC 27889

INSTRUCTIONS TO BIDDERS

AND

GENERAL CONDITIONS OF THE CONTRACT

STANDARD FORM FOR CONSTRUCTION PROJECTS

STATE CONSTRUCTION OFFICE

NORTH CAROLINA

DEPARTMENT OF ADMINISTRATION

Form OC-15

This document is intended for use on State capital construction projects and shall not be used on any project that is not reviewed and approved by the State Construction Office. Extensive modification to the General Conditions by means of "Supplementary General Conditions" is strongly discouraged. State agencies and institutions may include special requirements in "Division 1 – General Requirements" of the specifications, where they do not conflict with the General Conditions.

Twenty Fourth Edition, Revision 2 - September 2025:
Articles: 2.c, 20.a, 32.d, 33.c, 34, 52.b - h

INSTRUCTIONS TO BIDDERS

For a proposal to be considered it must be in accordance with the following instructions:

1. PROPOSALS

Proposals must be made in strict accordance with the Form of Proposal provided therefor, and all blank spaces for bids, alternates, and unit prices applicable to bidder's work shall be properly filled in. When requested alternates are not bid, the proposer shall so indicate by the words "No Bid". Any blanks shall also be interpreted as "No Bid". The bidder agrees that bid on Form of Proposal detached from specifications will be considered and will have the same force and effect as if attached thereto. Photocopied or faxed proposals will not be considered. Numbers shall be stated both in writing and in figures for the base bids and alternates. If figures and writing differ, the written number will supersede the figures.

Any modifications to the Form of Proposal (including alternates and/or unit prices) will disqualify the bid and may cause the bid to be rejected.

The bidder shall fill in the Form of Proposal as follows:

a. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.

b. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.

c. If the documents are executed on the part of a corporation, they shall be executed on the part of a corporation, they shall be executed by either the president or the vice president and the title of the office of such persons shall appear after their signatures.

d. If the proposal is made by a joint venture, it shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable.

Proposals should be addressed as indicated in the Advertisement for Bids and be delivered, enclosed in an opaque sealed envelope, marked "Proposal" and bearing the title of the work, name of the bidder, and the contractor's license number of the bidder. Bidders should clearly mark on the outside of the bid envelope which contract(s) they are bidding.

Bidder shall identify on the bid**,** the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts or an affidavit indicating work under contract will be self-performed, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f). Failure to comply with these requirements is grounds for rejection of the bid.

For projects bid in the single-prime alternative, the names and license numbers of major subcontractors shall be listed on the proposal form.

It shall be the specific responsibility of the bidder to deliver his bid to the proper official at the selected place and prior to the announced time for the opening of bids. Later delivery of a bid for any reason, including delivery by any delivery service, shall disqualify the bid.

Unit prices quoted in the proposal shall include overhead and profit and shall be the full compensation for the contractor's cost involved in the work. See General Conditions, Article 19c-1.

2. EXAMINATION OF CONDITIONS

It is understood and mutually agreed that by submitting a bid the bidder acknowledges that he has carefully examined all documents pertaining to the work, the location, accessibility and general character of the site of the work and all existing buildings and structures within and adjacent to the site, and has satisfied himself as to the nature of the work, the condition of existing buildings and structures, the conformation of the ground, the character, quality and quantity of the material to be encountered, the character of the equipment, machinery, plant and any other facilities needed preliminary to and during prosecution of the work, the general and local conditions, the construction hazards, and all other matters, including, but not limited to, the labor situation which can in any way affect the work under the contract, and including all safety measures required by the Occupational Safety and Health Act of 1970 and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a proposal the bidder acknowledges that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications and other contract documents for the construction of the work and that he accepts all the terms, conditions and stipulations contained therein; and that he is prepared to work in cooperation with other contractors performing work on the site.

Reference is made to contract documents for the identification of those surveys and investigation reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the work which have been relied upon by the designer in preparing the documents. The owner will make copies of all such surveys and reports available to the bidder upon request.

Each bidder may, at his own expense, make such additional surveys and investigations as he may deem necessary to determine his bid price for the performance of the work. Any on-site investigation shall be done at the convenience of the owner. Any reasonable request for access to the site will be honored by the owner.

3. BULLETINS AND ADDENDA

Any addenda to specifications issued during the time of bidding are to be considered covered in the proposal and in closing a contract they will become a part thereof. It shall be the bidder's responsibility to ascertain prior to bid time the addenda issued and to see that his bid includes any changes thereby required.

Should the bidder find discrepancies in, or omission from, the drawings or documents or should he be in doubt as to their meaning, he shall at once notify the designer who will send written instructions in the form of addenda to all bidders. Notification should be no later than seven (7) days prior to the date set for receipt of bids. Neither the owner nor the designer will be responsible for any oral instructions.

All addenda should be acknowledged by the bidder(s) on the Form of Proposal. However, even if not acknowledged, by submitting a bid, the bidder has certified that he has reviewed all issued addenda and has included all costs associated within his bid.

4. BID SECURITY

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a bid bond in an amount equal to not less than five percent (5%) of the proposal, said deposit to be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten (10) days after the award or to give satisfactory surety as required by law (G.S. 143-129).

Bid bond shall be conditioned that the surety will, upon demand, forthwith make payment to

the obligee upon said bond if the bidder fails to execute the contract. The owner may retain bid securities of any bidder(s) who may have a reasonable chance of award of contract for the full duration of time stated in the Notice to Bidders. Other bid securities may be released sooner, at the discretion of the owner. All bid securities (cash or certified checks) shall be returned to the bidders promptly after award of contracts, and no later then seven (7) days after expiration of the holding period stated in the Notice to Bidders. Standard Form of Bid Bond is included in these specifications and shall be used.

5. RECEIPT OF BIDS

Bids shall be received in strict accordance with requirements of the General Statutes of North Carolina. Bid security shall be required as prescribed by statute. Prior to the closing of the bid, the bidder will be permitted to change or withdraw his bid. Guidelines for opening of public construction bids are available from the State Construction Office.

6. OPENING OF BIDS

Upon opening, all bids shall be read aloud. Once bidding is closed, there shall not be any withdrawal of bids by any bidder and no bids may be returned by the designer to any bidder. After the opening of bids, no bid may be withdrawn, except under the provisions of General Statute 143-129.1, for a period of thirty days unless otherwise specified. Should the successful bidder default and fail to execute a contract, the contract may be awarded to the next lowest and responsible bidder. The owner reserves the unqualified right to reject any and all bids. Reasons for rejection may include, but shall not be limited to, the following:

a. If the Form of Proposal furnished to the bidder is not used or is altered.

b. If the bidder fails to insert a price for all bid items, alternates, and unit prices requested.

c. If the bidder adds any provisions reserving the right to accept or reject any award.

d. If there are unauthorized additions or conditional bids, or irregularities of any kind which tend to make the proposal incomplete, indefinite or ambiguous as to its meaning.

e. If the bidder fails to complete the proposal form where information is requested so the bid may be properly evaluated by the owner.

f. If the unit prices contained in the bid schedule are unacceptable to the owner and the State Construction Office.

g. If the bidder fails to comply with other instructions stated herein.

7. BID EVALUATION

The award of the contract will be made to the lowest responsible bidder as soon as practical. The owner may award on the basis of the base bid and any alternates the owner chooses.

Before awarding a contract, the owner may require the apparent low bidder to qualify himself to be a responsible bidder by furnishing any or all of the following data:

a. The latest financial statement showing assets and liabilities of the company or other information satisfactory to the owner.

b. A listing of completed projects of similar size.

c. Permanent name and address of place of business.

d. The number of regular employees of the organization and length of time the organization has been in business under present name.

e. The name and home office address of the surety proposed and the name and address of the responsible local claim agent.

f. The names of members of the firms who hold appropriate trade licenses, together with license numbers.

g. If prequalified, contractor info will be reviewed and evaluated comparatively to submitted prequalification package.

Failure or refusal to furnish any of the above information, if requested, shall constitute a basis for disqualification of any bidder.

In determining the lowest responsible, responsive bidder, the owner shall take into consideration the bidder's compliance with the requirements of G.S. 143-128.2(c), the past performance of the bidder on construction contracts for the State with particular concern given to completion times, quality of work, cooperation with other contractors, and cooperation with the designer and owner. Failure of the low bidder to furnish affidavit and/or documentation as required by G.S. 143-128.2(c) shall constitute a basis for disqualification of the bid.

Should the owner adjudge that the apparent low bidder is not the lowest responsible, responsive bidder by virtue of the above information, said apparent low bidder will be so notified and his bid security shall be returned to him.

8. PERFORMANCE BOND

The successful bidder, upon award of contract, shall furnish a performance bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

9. PAYMENT BOND

The successful bidder, upon award of contract, shall furnish a payment bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

10. PAYMENTS

Payments to the successful bidders (contractors) will be made on the basis of monthly estimates. See Article 31, General Conditions.

11. PRE-BID CONFERENCE

Prior to the date set for receiving bids, the Designer may arrange and conduct a Pre-Bid Conference for all prospective bidders. The purpose of this conference is to review project requirements and to respond to questions from prospective bidders and their subcontractors or material suppliers related to the intent of bid documents. Attendance by prospective bidders shall be as required by the "Notice to Bidders".

12. SUBSTITUTIONS

In accordance with the provisions of G.S. 133-3, material, product, or equipment substitutions proposed by the bidders to those specified herein can only be considered during the bidding phase until ten (10) days prior to the receipt of bids when submitted to the Designer with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as potential change order.

Submittals for proposed substitutions shall include the following information:

a. Name, address, and telephone number of manufacturer and supplier as appropriate.

b. Trade name, model or catalog designation.

c. Product data including performance and test data, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.

d. Detailed comparison with specified products including performance capabilities, warranties, and test results.

e. Other pertinent data including data requested by the Designer to confirm product equality.

If a proposed material, product, or equipment substitution is deemed equal by the Designer to those specified, all bidders of record will be notified by Addendum**.**

GENERAL CONDITIONS OF THE CONTRACT

The use or reproduction of this document or any part thereof is authorized for and limited to use on projects of the State of North Carolina, and is distributed by, through and at the discretion of the State Construction Office, Raleigh, North Carolina, for that distinct and sole purpose.

TABLE OF CONTENTS

ARTICLE	TITLE	PAGE
1	Definitions	9
2	Intent and Execution of Documents	11
3	Clarifications and Detail Drawings	12
4	Copies of Drawings and Specifications	12
5	Shop Drawings, Submittals, Samples, Data	13
6	Working Drawings and Specifications at the Job Site	13
7	Ownership of Drawings and Specifications	14
8	Materials, Equipment, Employees	14
9	Royalties, Licenses and Patent	15
10	Permits, Inspections, Fees, Regulations	15
11	Protection of Work, Property and the Public	15
12	Sedimentation Pollution Control Act of 1973	17
13	Inspection of the Work	17
14	Construction Supervision and Schedule	18
15	Separate Contracts and Contractor Relationships	22
16	Subcontracts and Subcontractors	22
17	Contractor and Subcontractor Relationships	23
18	Designer's Status	24
19	Changes in the Work	25
20	Claims for Extra Cost	27
21	Minor Changes in the Work	28
22	Uncorrected Faulty Work	28
23	Time of Completion, Delays, Extension of Time	28
24	Partial Utilization: Beneficial Occupancy	30
25	Final Inspection, Acceptance, and Project Closeout	30
26	Correction of Work Before Final Payment	31
27	Correction of Work After Final Payment	31
28	Owner's Right to Do Work	32
29	Annulment of Contract	32
30	Contractor's Right to Stop Work or Terminate the Contract	33
31	Requests for Payments	33
32	Certificates of Payment and Final Payment	34
33	Payments Withheld	35
34	Minimum Insurance Requirements	36
35	Performance Bond and Payment Bond	37
36	Contractor's Affidavit	37
37	Assignments	38
38	Use of Premises	38
39	Cutting, Patching and Digging	38
40	Utilities, Structures, Signs	38
41	Cleaning Up	40
42	Guarantee	40

43 Codes and Standards 41
44 Indemnification 41
45 Taxes 41
46 Equal Opportunity Clause 42
47 Employment of the Handicapped 42
48 Asbestos-Containing Materials (ACM) 43
49 Minority Business Participation 43
50 Contractor Evaluation 43
51 Gifts 43
52 Auditing Access to Persons and Records 44
53 North Carolina False Claims Act 45
54 Termination for Convenience 46

ARTICLE 1 - DEFINITIONS

a. The **contract documents** consist of the Notice to Bidders; Instructions to Bidders; General Conditions of the Contract; special conditions if applicable; Supplementary General Conditions; the drawing and specifications, including all bulletins, addenda or other modifications of the drawings and specifications incorporated into the documents prior to their execution; the proposal; the contract; the performance bond; the payment bond; insurance certificates; the approval of the attorney general; and the certificate of the Office of State Budget and Management. All of these items together form the contract.

b. The **owner** is the State of North Carolina through the agency named in the contract.

c. The **designer(s)** are those referred to within this contract, or their authorized representatives. The Designer(s), as referred to herein, shall mean architect and/or engineer. They will be referred to hereinafter as if each were of the singular number, masculine gender.

d. The **contractor**, as referred to hereinafter, shall be deemed to be either of the several contracting parties called the "Party of the First Part" in either of the several contracts in connection with the total project. Where, in special instances hereinafter, a particular contractor is intended, an adjective precedes the word "contractor," as "general," "heating," etc. For the purposes of a single prime contract, the term Contractor shall be deemed to be the single contracting entity identified as the “Party of the First Part” in the single Construction Contract. Any references or adjectives that name or infer multiple prime contractors shall be interpreted to mean the single prime Contractor.

e. A **subcontractor**, as the term is used herein, shall be understood to be one who has entered into a direct contract with a contractor, and includes one who furnishes materials worked to a special design in accordance with plans and specifications covered by the contract, but does not include one who only sells or furnishes materials not requiring work so described or detailed.

f. **Written notice** shall be defined as notice in writing delivered in person to the contractor, or to a partner of the firm in the case of a partnership, or to a member of the contracting organization, or to an officer of the organization in the case of a corporation, or sent to the last known business address of the contracting organization by registered mail.

g. **Work**, as used herein as a noun, is intended to include materials, labor, and workmanship of the appropriate contractor.

h. The **project** is the total construction work to be performed under the contract documents by the several contractors.

i. **Project Expediter,** as used herein, is an entity stated in the contract documents, designated to effectively facilitate scheduling and coordination of work activities. See Article 14(f) for responsibilities of a Project Expediter. **For the purposes of a single prime contract, the single prime contractor shall be designated as the Project Expediter.**

j. **Change order**, as used herein, shall mean a written order to the contractor subsequent to the signing of the contract authorizing a change in the contract. The change order shall be signed by the contractor, designer and the owner, and approved by the State Construction Office, in that order (Article 19).

k. **Field Order,** as used herein, shall mean a written approval for the contractor to proceed with the work requested by owner prior to issuance of a formal Change Order. The field order shall be signed by the contractor, designer, owner, and State Construction Office.

l. **Time of completion**, as stated in the contract documents, is to be interpreted as consecutive calendar days measured from the date established in the written Notice to Proceed, or such other date as may be established herein (Article 23).

m. **Liquidated damages,** as stated in the contract documents [, is an amount reasonably estimated in advance to cover the consequential damages associated with the Owner's economic loss in not being able to use the Project for its intended purposes at the end of the contract's completion date as amended by change order, if any, by reason of failure of the contractor(s) to complete the work within the time specified. Liquidated damages does not include the Owner's extended contract administration costs (including but not limited to additional fees for architectural and engineering services, testing services, inspection services, commissioning services, etc.), such other damages directly resulting from delays caused solely by the contractor, or consequential damages that the Owner identified in the bid documents that may be impacted by any delay caused solely by the Contractor (e.g., if a multi-phased project-subsequent phases, delays in start other projects that are dependent on the completion of this Project, extension of leases and/or maintenance agreements for other facilities).

n. **Surety**, as used herein, shall mean the bonding company or corporate body which is bound with and for the contractor, and which engages to be responsible for the contractor and his acceptable performance of the work.

o. **Routine written communications between the Designer and the Contractor** are any communication other than a "request for information" provided in letter, memo, or transmittal format, sent by mail, courier, electronic mail, or facsimile. Such communications can not be identified as "request for information".

p. **Clarification or Request for information (RFI)** is a request from the Contractor seeking an interpretation or clarification by the Designer relative to the contract documents. The RFI, which shall be labeled (RFI), shall clearly and concisely set forth the issue or item requiring clarification or interpretation and why the response is needed. The RFI must set forth the Contractor's interpretation or understanding of the contract documents requirements in question, along with reasons for such an understanding.

q. **Approval** means written or imprinted acknowledgement that materials, equipment or methods of construction are acceptable for use in the work**.**

r. **Inspection** shall mean examination or observation of work completed or in progress to determine its compliance with contract documents.

s. **"Equal to" or "approved equal"** shall mean materials, products, equipment, assemblies, or installation methods considered equal by the bidder in all characteristics (physical, functional, and aesthetic) to those specified in the contract documents. Acceptance of equal is subject to approval of Designer and owner.

t. **"Substitution" or "substitute"** shall mean materials, products, equipment, assemblies, or installation methods deviating in at least one characteristic (physical, functional, or aesthetic) from those specified, but which in the opinion of the bidder would improve competition and/or enhance the finished installation. Acceptance of substitution is subject to the approval of the Designer and owner.

u. **Provide** shall mean furnish and install complete in place, new, clean, operational, and ready for use.

v. **Indicated and shown** shall mean provide as detailed, or called for, and reasonably implied in the contract documents.

w. **Special inspector** is one who inspects materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with the approved construction documents and referenced standards.

x. **Commissioning** is a quality assurance process that verifies and documents that building components and systems operate in accordance to the owner's project requirements and the project design documents.

y. **Designer Final Inspection** is the inspection performed by the design team to determine the completeness of the project in accordance with approved plans and specifications. This inspection occurs prior to SCO final inspection.

z. **SCO Final Inspection** is the inspection performed by the State Construction Office to determine the completeness of the project in accordance with NC Building Codes and approved plans and specifications.

aa. **Beneficial Occupancy** is requested by the owner and is occupancy or partial occupancy of the building after all life safety items have been completed as determined by the State Construction Office. Life safety items include but not limited to fire alarm, sprinkler, egress and exit lighting, fire rated walls, egress paths and security.

bb. Final Acceptance is the date in which the State Construction Office accepts the construction as totally complete. This includes the SCO Final Inspection and certification by the designer that all punch lists are completed.

ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

a. The drawings and specifications are complementary, one to the other, and that which is shown on the drawings or called for in the specifications shall be as binding as if it were both called for and shown. The intent of the drawings and specifications is to establish the scope of all labor, materials, transportation, equipment, and any and all other things necessary to provide a bid for a complete job. In case of discrepancy or disagreement in the contract documents, the order of precedence shall be: Form of Contract, specifications, large-scale detail drawings, small-scale drawings.

b. The wording of the specifications shall be interpreted in accordance with common usage of the language except that words having a commonly used technical or trade meaning shall be so interpreted in preference to other meanings.

c. The contractor shall execute each copy of the proposal, contract, performance bond and payment bond as follows:

1. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.

2. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.

3. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and the title of the office of such persons shall appear after their signatures.

4. If the documents are made by a joint venture, they shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable to each particular member.

5. The bonds shall be executed by an attorney-in-fact. There shall be attached to each copy of the bond a certified copy of power of attorney properly executed and dated.

6. The seal of the bonding company shall be impressed on each signature page of the bonds.

7. The date of performance and payment bond shall not be prior to the date of the contract.

ARTICLE 3 - CLARIFICATIONS AND DETAIL DRAWINGS

a. In such cases where the nature of the work requires clarification by the designer, such clarification shall be furnished by the designer with reasonable promptness by means of written instructions or detail drawings, or both. Clarifications and drawings shall be consistent with the intent of contract documents, and shall become a part thereof.

b. The contractor(s) and the designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject to addition or change in accordance with progress of the work. The designer shall furnish drawings or clarifications in accordance with that schedule. The contractor shall not proceed with the work without such detail drawings and/or written clarifications.

ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS

a. The designer or Owner shall furnish free of charge to the contractors electronic copies of plans and specifications. If requested by the contractor, paper copies of plans and specifications shall be furnished free of charge as follows:

1. General contractor - Up to twelve (12) sets of general contractor drawings and specifications, up to six (6) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

2. Each other contractor - Up to six (6) sets of the appropriate drawings and specifications, up to three (3) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

3. Additional sets shall be furnished at cost, including mailing, to the contractor upon request by the contractor. This cost shall be stated in the bidding documents.

4. For the purposes of a single-prime contract, the contractor shall receive up to 30 sets of drawings and specifications, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work- in-place that is at variance with the contract documents.

ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA

a. Within 15 consecutive calendar days after the notice to proceed, each prime contractor shall submit a schedule for submission of all shop drawings, product data, samples, and similar submittals through the Project Expediter to the Designer. This schedule shall indicate the items, relevant specification sections, other related submittal, data, and the date when these items will be furnished to the designer.

b. The Contractor(s) shall review, approve and submit to the Designer all Shop Drawings, Coordination Drawings, Product Data, Samples, Color Charts, and similar submittal data required or reasonably implied by the Contract Documents. Required Submittals shall bear the Contractor's stamp of approval, any exceptions to the Contract Documents shall be noted on the submittals, and copies of all submittals shall be of sufficient quantity for the Designer to retain up to three (3) copies of each submittal for his own use plus additional copies as may be required by the Contractor. Submittals shall be presented to the Designer in accordance with the schedule submitted in paragraph (a). so as to cause no delay in the activities of the Owner or of separate Contractors.

c. The Designer shall review required submittals promptly, noting desired corrections if any, and retaining three (3) copies (1 for the Designer, 1 for the owner and 1 for SCO) for his use. The remaining copies of each submittal shall be returned to the Contractor not later than twenty (20) days from the date of receipt by the Designer, for the Contractor's use or for corrections and resubmittal as noted by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittal*s.*

d. Approval of shop drawings/submittals by the Designer shall not be construed as relieving the Contractor from responsibility for compliance with the design or terms of the contract documents nor from responsibility of errors of any sort in the shop drawings, unless such lack of compliance or errors first have been called in writing to the attention of the Designer by the Contractor.

ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE

a. The contractor shall maintain, in readable condition at his job office, one complete set of working drawings and specifications for his work including all shop drawings. Such drawings and specifications shall be available for use by the designer, his authorized representative, owner or State Construction Office.

b. The contractor shall maintain at the job office, a day-to-day record of work-in-place that is at variance with the contract documents. Such variations shall be fully noted on project drawings by the contractor and submitted to the designer upon project completion and no later than 30 days after final acceptance of the project.

c. The contractor shall maintain at the job office a record of all required tests that have been performed, clearly indicating the scope of work inspected and the date of approval or rejection.

ARTICLE 7 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS

All drawings and specifications are instruments of service and remain the property of the owner. The use of these instruments on work other than this contract without permission of the owner is prohibited. All copies of drawings and specifications other than contract copies shall be returned to the owner upon request after completion of the work.

ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES

a. The contractor shall, unless otherwise specified, supply and pay for all labor, transportation, materials, tools, apparatus, lights, power, heat, sanitary facilities, water, scaffolding and incidentals necessary for the completion of his work, and shall install, maintain and remove all equipment of the construction, other utensils or things, and be responsible for the safe, proper and lawful construction, maintenance and use of same, and shall construct in the best and most workmanlike manner, a complete job and everything incidental thereto, as shown on the plans, stated in the specifications, or reasonably implied therefrom, all in accordance with the contract documents.

b. All materials shall be new and of quality specified, except where reclaimed material is authorized herein and approved for use. Workmanship shall at all times be of a grade accepted as the best practice of the particular trade involved, and as stipulated in written standards of recognized organizations or institutes of the respective trades except as exceeded or qualified by the specifications.

c. Upon notice, the contractor shall furnish evidence as to quality of materials.

d. Products are generally specified by ASTM or other reference standard and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer combination listed. However, the contractor shall be aware that the cited examples are used only to denote the quality standard of product desired and that they do not restrict bidders to a specific brand, make, manufacturer or specific name; that they are used only to set forth and convey to bidders the general style, type, character and quality of product desired; and that equivalent products will be acceptable. Request for substitution of materials, items, or equipment shall be submitted to the designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Alternate materials may be requested after the award if it can clearly be demonstrated that it is an added benefit to the owner and the designer and owner approves.

e. The designer is the judge of equality for proposed substitution of products, materials or equipment.

f. If at any time during the construction and completion of the work covered by these contract documents, the language, conduct, or attire of any workman of the various crafts be adjudged a nuisance to the owner or designer, or if any workman be considered detrimental to the work, the contractor shall order such parties removed immediately from grounds.

ARTICLE 9 - ROYALTIES, LICENSES AND PATENTS

It is the intention of the contract documents that the work covered herein will not constitute in

any way infringement of any patent whatsoever unless the fact of such patent is clearly evidenced herein. The contractor shall protect and save harmless the owner against suit on account of alleged or actual infringement. The contractor shall pay all royalties and/or license fees required on account of patented articles or processes, whether the patent rights are evidenced hereinafter.

ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS

a. The contractor shall give all notices and comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work under this contract. If the contractor observes that the drawings and specifications are at variance therewith, he shall promptly notify the designer in writing. See Instructions to Bidders, Paragraph 3, Bulletins and Addenda. Any necessary changes required after contract award shall be made by change order in accordance with Article 19. If the contractor performs any work knowing it to be contrary to such laws, ordinances, codes, rules and regulations, and without such notice to the designer, he shall bear all cost arising therefrom. Additional requirements implemented after bidding will be subject to equitable negotiations.

b. All work under this contract shall conform to the North Carolina State Building Code and other State, local and national codes as are applicable. The cost of all required inspections and permits shall be the responsibility of the contractor and included within the bid proposal. All water taps, meter barrels, vaults and impact fees shall be paid by the contractor unless otherwise noted.

d. Projects constructed by the State of North Carolina or by any agency or institution of the State are not subject to inspection by any county or municipal authorities and are not subject to county or municipal building codes. The contractor shall, however, cooperate with the county or municipal authorities by obtaining building permits. Permits shall be obtained at no cost.

e. Projects involving local funding (community colleges) are subject also to county and municipal building codes and inspection by local authorities. The contractor shall pay the cost of these permits and inspections.

ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC

a. The contractors shall be jointly responsible for the entire site and the building or construction of the same and provide all the necessary protections, as required by the owner or designer, and by laws or ordinances governing such conditions. They shall be responsible for any damage to the owner's property, or of that of others on the job, by them, their personnel, or their subcontractors, and shall make good such damages. They shall be responsible for and pay for any damages caused to the owner. All contractors shall have access to the project at all times.

b. The contractor shall provide cover and protect all portions of the structure when the work is not in progress, provide and set all temporary roofs, covers for doorways, sash and windows, and all other materials necessary to protect all the work on the building, whether set by him, or any of the subcontractors. Any work damaged through the lack of proper protection or from any other cause, shall be repaired or replaced without extra cost to the owner.

c. No fires of any kind will be allowed inside or around the operations during the course of construction without special permission from the designer and owner.

d. The contractor shall protect all trees and shrubs designated to remain in the vicinity of the operations by building substantial boxes around same. He shall barricade all walks, roads, etc., as directed by the designer to keep the public away from the construction. All trenches, excavations or other hazards in the vicinity of the work shall be well barricaded and properly lighted at night.

e. The contractor shall provide all necessary safety measures for the protection of all persons on the job, including the requirements of the A.G.C. *Accident Prevention Manual in Construction*, as amended, and shall fully comply with all state laws or regulations and North Carolina State Building Code requirements to prevent accident or injury to persons on or about the location of the work. He shall clearly mark or post signs warning of hazards existing, and shall barricade excavations, elevator shafts, stairwells and similar hazards. He shall protect against damage or injury resulting from falling materials and he shall maintain all protective devices and signs throughout the progress of the work.

f. The contractor shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor relating to Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926, published in Volume 39, Number 122, Part II, June 24, 1974, *Federal Register*), and revisions thereto as adopted by General Statutes of North Carolina 95-126 through 155.

g. The contractor shall designate a responsible person of his organization as safety officer/inspector to inspect the project site for unsafe health and safety hazards, to report these hazards to the contractor for correction, and whose duties also include accident prevention on the project, and to provide other safety and health measures on the project site as required by the terms and conditions of the contract. The name of the safety inspector shall be made known to the designer and owner at the time of the preconstruction conference and in all cases prior to any work starting on the project.

h. In the event of emergency affecting the safety of life, the protection of work, or the safety of adjoining properties, the contractor is hereby authorized to act at his own discretion, without further authorization from anyone, to prevent such threatened injury or damage. Any compensation claimed by the contractor on account of such action shall be determined as provided for under Article 19(b).

i. Any and all costs associated with correcting damage caused to adjacent properties of the construction site or staging area shall be borne by the contractor. These costs shall include but not be limited to flooding, mud, sand, stone, debris, and discharging of waste products.

ARTICLE 12 - SEDIMENTATION POLLUTION CONTROL ACT OF 1973

a. Any land-disturbing activity performed by the contractor(s) in connection with the project shall comply with all erosion control measures set forth in the contract documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).

b. Upon receipt of notice that a land-disturbing activity is in violation of said act, the contractor(s) shall be responsible for ensuring that all steps or actions necessary to bring

the project in compliance with said act are promptly taken.

c. The contractor(s) shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this article.

d. To the fullest extent permitted by law, the contractor(s) shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of work or failure of performance of work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this article.

ARTICLE 13 - INSPECTION OF THE WORK

a. It is a condition of this contract that the work shall be subject to inspection during normal working hours and during any time work is in preparation and progress by the designer, designated official representatives of the owner, State Construction Office and those persons required by state law to test special work for official approval. The contractor shall therefore provide safe access to the work at all times for such inspections.

b. All instructions to the contractor will be made only by or through the designer or his designated project representative. Observations made by official representatives of the owner shall be conveyed to the designer for review and coordination prior to issuance to the contractor.

c. All work shall be inspected by designer, special inspector and/or State Construction Office prior to being covered by the contractor. Contractor shall give a minimum two weeks notice unless otherwise agreed to by all parties. If inspection fails, after the first reinspection all costs associated with additional reinspections shall be borne by the contractor.

d. Where special inspection or testing is required by virtue of any state laws, instructions of the designer, specifications or codes, the contractor shall give adequate notice to the designer of the time set for such inspection or test, if the inspection or test will be conducted by a party other than the designer. Such special tests or inspections will be made in the presence of the designer, or his authorized representative, and it shall be the contractor's responsibility to serve ample notice of such tests.

e. All laboratory tests shall be paid by the owner unless provided otherwise in the contract documents except the general contractor shall pay for laboratory tests to establish design mix for concrete, and for additional tests to prove compliance with contract documents where materials have tested deficient except when the testing laboratory did not follow the appropriate ASTM testing procedures.

f. Should any work be covered up or concealed prior to inspection and approval by the designer, special inspector, and/or State Construction Office such work shall be uncovered or exposed for inspection, if so requested by the designer in writing. Inspection of the work will be made upon notice from the contractor. All cost involved in uncovering, repairing, replacing, recovering and restoring to design condition, the work that has been covered or concealed will be paid by the contractor involved.

ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE

a. Throughout the progress of the work, each contractor shall keep at the job site, a competent superintendent and supervisory staff satisfactory to the designer and the owner. The superintendent and supervisory staff shall not be changed without the consent of the designer and owner unless said superintendent ceases to be employed by the contractor or ceases to be competent as determined by the contractor, designer or owner. The superintendent and other staff designated by the contractor in writing shall have authority to act on behalf of the contractor, and instructions, directions or notices given to him shall be as binding as if given to the contractor. However, directions, instructions, and notices shall be confirmed in writing.

b. The contractor shall examine and study the drawings and specifications and fully understand the project design, and shall provide constant and efficient supervision to the work. Should he discover any discrepancies of any sort in the drawings or specifications, he shall report them to the designer without delay. He will not be held responsible for discrepancies in the drawings and/or specifications, but shall be held responsible to report them should they become known to him.

c. All contractors shall be required to cooperate and consult with each other during the construction of this project. Prior to installation of work, all contractors shall jointly prepare coordination drawings, showing locations of various ductworks, piping, motors, pumps, and other mechanical or electrical equipment, in relation to the structure, walls and ceilings. These drawings shall be submitted to the designer through the Project Expediter for information only. Each contractor shall lay out and execute his work to cause the least delay to other contractors. Each contractor shall be financially responsible for any damage to other contractor's work and for undue delay caused to other contractors on the project.

d. The contractor is required to attend job site progress conferences as called by the designer. The contractor shall be represented at these job progress conferences by both home office and project personnel. These representatives shall have authority to act on behalf of the contractor. These meetings shall be open to subcontractors, material suppliers and any others who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the project on schedule and to complete the project within the specified contract time. Each contractor shall be prepared to assess progress of the work as required in his particular contract and to recommend remedial measures for correction of progress as may be appropriate. The designer or his authorized representative shall be the coordinator of the conferences and shall preside as chairman. The contractor shall turn over a copy of his daily reports to the Designer and Owner at the job site progress conference. Owner will determine daily report format.

e The contractor(s) shall, employ an engineer or a land surveyor licensed in the State of North Carolina to lay out the work and to establish a bench mark in a location where same will not be disturbed and where direct instruments sights may be taken.

f. The designer shall designate a Project Expediter on projects involving two or more prime contracts. The Project Expediter shall be designated in the Supplementary General Conditions. The Project Expediter shall have at a minimum the following responsibilities.

1. Prepare the project construction schedule and shall allow all prime contractors (multi-prime contract) and subcontractors (single-prime contract) performing general, plumbing, HVAC, and electrical work equal input into the preparation of

the initial construction schedule.

2. Maintain a project progress schedule for all contractors.

3. Give adequate notice to all contractors to ensure efficient continuity of all phases of the work.

4. Notify the designer of any changes in the project schedule.

5. Recommend to the owner whether payment to a contractor shall be approved.

g. It shall be the responsibility of the Project Expediter to cooperate with and obtain from several prime contractors and subcontractors on the job, their respective work activities and integrate these activities into a project construction schedule in form of a detailed bar chart or Critical Path Method (CPM), schedule. Each prime contractor shall provide work activities within fourteen (14) days of request by the Project Expediter. A "work activity", for scheduling purposes, shall be any component or contractual requirement of the project requiring at least one (1) day, but not more than fourteen (14) days, to complete or fulfill. The project construction schedule shall graphically show all salient features of the work required to construct the project from start to finish and within the allotted time established in the contract. The time (in days) between the contractor's early completion and contractual completion dates is part of the project total float time; and shall be used as such, unless amended by a change order. On a multi-prime project, each prime contractor shall review the proposed construction schedule and approve same in writing. The Project Expediter shall submit the proposed construction schedule to the designer for comments. The complete Project construction schedule shall be of the type set forth in the Supplementary General Condition or subparagraph (1) or (2) below, as appropriate:

1. For a project with total contracts of $500,000 or less, a bar chart schedule will satisfy the above requirement. The schedule shall indicate the estimated starting and completion dates for each major element of the work.

2. For a project with total contracts over $500,000, a Critical Path Method (CPM) schedule shall be utilized to control the planning and scheduling of the Work. The CPM schedule shall be the responsibility of the Project Expediter and shall be paid for by the Project Expediter.

Bar Chart Schedule: Where a bar chart schedule is required, it shall be time-scaled in weekly increments, shall indicate the estimated starting and completion dates for each major element of the work by trade and by area, level, or zone, and shall schedule dates for all salient features, including but not limited to the placing of orders for materials, submission of shop drawings and other Submittals for approval, approval of shop drawings by designers, the manufacture and delivery of material, the testing and the installation of materials, supplies and equipment, and all Work activities to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s). Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

CPM Schedule: Where a CPM schedule is required, it shall be in time-scaled precedence format using the Project Expediter's logic and time estimates. The CPM schedule shall be drawn or plotted with activities grouped or zoned by Work area or subcontract as opposed to a random (or scattered) format. The CPM schedule shall be time-scaled on a weekly basis and shall be drawn or plotted at a level of detail and logic which will schedule all salient features of the work to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s). Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

The CPM schedule will identify and describe each activity, state the duration of each activity, the calendar dates for the early and late start and the early and late finish of each activity, and clearly highlight all activities on the critical path. "Total float" and "free float" shall be indicated for all activities. Float time shall not be considered for the exclusive use or benefit of either the Owner or the Contractor, but must be allocated in the best interest of completing the Work within the Contract time. Extensions to the Contract time, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change. On contracts with a price over $2,500,000, the CPM schedule shall also show what part of the Contract Price is attributable to each activity on the schedule, the sum of which for all activities shall equal the total Contract Price.

Early Completion of Project: The Contractor may attempt to complete the project prior to the Contract Completion Date. However, such planned early completion shall be for the Contractor's convenience only and shall not create any additional rights of the Contractor or obligations of the Owner under this Contract, nor shall it change the Time for Completion or the Contract Completion Date. The Contractor shall not be required to pay liquidated damages to the Owner because of its failure to complete by its planned earlier date. Likewise, the Owner shall not pay the Contractor any additional compensation for early completion nor will the Owner owe the Contractor any compensation should the Owner, its officers, employees, or agents cause the Contractor not to complete earlier than the date required by the Contract Documents.

h. The proposed project construction schedule shall be presented to the designer no later than fifteen (15) days after written notice to proceed. No application for payment will be processed until this schedule is accepted by the designer and owner.

i. The approved project construction schedule shall be distributed to all contractors and displayed at the job site by the Project Expediter.

j. The several contractors shall be responsible for their work activities and shall notify the Project Expediter of any necessary changes or adjustments to their work. The Project Expediter shall maintain the project construction schedule, making biweekly adjustments, updates, corrections, etc., that are necessary to finish the project within the Contract time, keeping all contractors and the designer fully informed. Copy of a bar chart schedule annotated to show the current progress shall be submitted by the Contractor(s) to the designer, along with monthly request for payment. For project requiring CPM schedule, the Contractor shall submit a biweekly report of the status of all activities. The bar chart schedule or status report shall show the actual Work completed

to date in comparison with the original Work scheduled for all activities. If any activities of the work of several contractors are behind schedule, the contractor must indicate in writing, what measures will be taken to bring each such activity back on schedule and to ensure that the Contract Completion Date is not exceeded. A plan of action and recovery schedule shall be developed and submitted to the designer by the Project Expediter, when (1) the contractor's report indicates delays, that are in the opinion of the designer or the owner, of sufficient magnitude that the contractor's ability to complete the work by the scheduled completion is brought into question; (2) the updated construction schedule is thirty (30) days behind the planned or baseline schedule and no legitimate time extensions, as determined by the Designer, are in process; and (3) the contractor desires to make changes in the logic (sequencing of work) or the planned duration of future activities of the CPM schedule which, in the opinion of the designer or the owner, are of a major nature. The plan of action, when required shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written demand. The recovery schedule, when required, shall be submitted to the Owner within five (5) calendar days of the Contractor's receiving the Owner's written demand. Failure to provide an updated construction schedule or a recovery schedule may be grounds for rejection of payment applications or withholding of funds as set forth in Article 33.

k. The Project Expediter shall notify each contractor of such events or time frames that are critical to the progress of the job. Such notice shall be timely and reasonable. Should the progress be delayed due to the work of any of the several contractors, it shall be the duty of the Project Expediter to immediately notify the contractor(s) responsible for such delay, the designer, the State Construction Office and other prime contractors. The designer shall determine the contractor(s) who caused the delays and notify the bonding company of the responsible contractor(s) of the delays; and shall make a recommendation to the owner regarding further action.

l. Designation as Project Expediter entails an additional project control responsibility and does not alter in any way the responsibility of the contractor so designated, nor the responsibility of the other contractors involved in the project. The project expeditor's Superintendent(s) shall be in attendance at the Project site at all times when work is in progress unless conditions are beyond the control of the Contractor or until termination of the Contract in accordance with the Contract Documents. It is understood that such Superintendent shall be acceptable to the Owner and Designer and shall be the one who will be continued in that capacity for the duration of the project unless he ceases to be on the Contractor's payroll or the Owner otherwise agrees. The Superintendent shall not be employed on any other project for or by the Contractor or by any other entity during the course of the Work. If the Superintendent is employed by the Contractor on another project without the Owner's approval, then the Owner may deduct from the Contractor's monthly general condition costs and amount representing the Superintendent's cost and shall deduct that amount for each month thereafter until the Contractor has the Superintendent back on the Owner's Project full-time.

ARTICLE 15 - SEPARATE CONTRACTS AND CONTRACTOR RELATIONSHIPS

a. Effective from January 1, 2002, Chapter 143, Article 8, was amended, to allow public contracts to be delivered by the following delivery methods: single-prime, dual (single-prime and separate-prime), construction manager at risk, and alternative contracting method as approved by the State Building Commission. The owner reserves the right to prepare separate specifications, receive separate bids, and award separate contracts for such other major items of work as may be in the best interest of the State. For the purposes of a single prime contract, refer to Article 1 – Definitions.

b. All contractors shall cooperate with each other in the execution of their work, and shall plan their work in such manner as to avoid conflicting schedules or delay of the work. See Article 14, Construction Supervision.

c. If any part of contractor's work depends upon the work of another contractor, defects which may affect that work shall be reported to the designer in order that prompt inspection may be made and the defects corrected. Commencement of work by a contractor where such condition exists will constitute acceptance of the other contractor's work as being satisfactory in all respects to receive the work commenced, except as to defects which may later develop. The designer shall be the judge as to the quality of work and shall settle all disputes on the matter between contractors.

d. Any mechanical or electrical work such as sleeves, inserts, chases, openings, penetrations, etc., which is located in the work of the general contractor shall be built in by the general contractor. The respective mechanical and electrical contractors shall set all sleeves, inserts and other devices that are to be incorporated into the structure in cooperation and under the supervision of the general contractor. The responsibility for the exact location of such items shall be that of the mechanical and/or electrical contractor.

e. The designer and the owner shall have access to the work whenever it is in preparation and progress and during normal working hours. The contractor shall provide facilities for such access so the designer may perform his functions under the contract documents.

f. Should a contractor cause damage to the work or property of another contractor, he shall be directly responsible, and upon notice, shall promptly settle the claim or otherwise resolve the dispute.

ARTICLE 16 - SUBCONTRACTS AND SUBCONTRACTORS

a. Within thirty (30) days after award of the contract, the contractor shall submit to the designer, owner and to the State Construction Office a list giving the names and addresses of subcontractors and equipment and material suppliers he proposes to use, together with the scope of their respective parts of the work. Should any subcontractor be disapproved by the designer or owner, the designer or owner shall submit his reasons for disapproval in writing to the State Construction Office for its consideration with a copy to the contractor. If the State Construction Office concurs with the designer's or owner's recommendation, the contractor shall submit a substitute for approval. The designer and owner shall act promptly in the approval of subcontractors, and when approval of the list is given, no changes of subcontractors will be permitted except for cause or reason considered justifiable by the designer or owner.

b. The designer will furnish to any subcontractor, upon request, evidence regarding amounts of money paid to the contractor on account of the subcontractor's work.

c. The contractor is and remains fully responsible for his own acts or omissions as well as those of any subcontractor or of any employee of either. The contractor agrees that no contractual relationship exists between the subcontractor and the owner in regard to the contract, and that the subcontractor acts on this work as an agent or employee of the contractor.

d. The owner reserves the right to limit the amount of portions of work to be subcontracted as hereinafter specified

ARTICLE 17 - CONTRACTOR AND SUBCONTRACTOR RELATIONSHIPS

The contractor agrees that the terms of these contract documents shall apply equally to each subcontractor as to the contractor, and the contractor agrees to take such action as may be necessary to bind each subcontractor to these terms. The contractor further agrees to conform to the Code of Ethical Conduct as adopted by the Associated General Contractors of America, Inc., with respect to contractor-subcontractor relationships, and that payments to subcontractors shall be made in accordance with the provisions of G.S. 143-134.1 titled Interest on final payments due to prime contractors: payments to subcontractors.

a. On all public construction contracts which are let by a board or governing body of the state government or any political subdivision thereof, except contracts let by the Department of Transportation pursuant to G.S. 136-28.1, the balance due prime contractors shall be paid in full within 45 days after respective prime contracts of the project have been accepted by the owner, certified by the architect, engineer or designer to be completed in accordance with terms of the plans and specifications, or occupied by the owner and used for the purpose for which the project was constructed, whichever occurs first. Provided, however, that whenever the architect or consulting engineer in charge of the project determines that delay in completion of the project in accordance with terms of the plans and specifications is the fault of the contractor, the project may be occupied and used for the purposes for which it was constructed without payment of any interest on amounts withheld past the 45 day limit. No payment shall be delayed because of the failure of another prime contractor on such project to complete his contract. Should final payment to any prime contractor beyond the date such contracts have been certified to be completed by the designer or architect, accepted by the owner, or occupied by the owner and used for the purposes for which the project was constructed, be delayed by more than 45 days, said prime contractor shall be paid interest, beginning on the 46th day, at the rate of one percent (1%) per month or fraction thereof unless a lower rate is agreed upon on such unpaid balance as may be due. In addition to the above final payment provisions, periodic payments due a prime contractor during construction shall be paid in accordance with the payment provisions of the contract documents or said prime contractor shall be paid interest on any such unpaid amount at the rate stipulated above for delayed final payments. Such interest shall begin on the date the payment is due and continue until the date on which payment is made. Such due date may be established by the terms of the contract. Funds for payment of such interest on state-owned projects shall be obtained from the current budget of the owning department, institution or agency. Where a conditional acceptance of a contract exists, and where the owner is retaining a reasonable sum pending correction of such conditions, interest on such reasonable sum shall not apply.

b. Within seven days of receipt by the prime contractor of each periodic or final payment, the prime contractor shall pay the subcontractor based on work completed or service provided under the subcontract. Should any periodic or final payment to the subcontractor be delayed by more than seven days after receipt of periodic or final payment by the prime contractor, the prime contractor shall pay the subcontractor interest, beginning on the eighth day, at the rate of one percent (1%) per month or fraction thereof on such unpaid balance as may be due.

c. The percentage of retainage on payments made by the prime contractor to the subcontractor shall not exceed the percentage of retainage on payments made by the owner to the prime contractor. Any percentage of retainage on payments made by the prime contractor to the subcontractor that exceeds the percentage of retainage on payments made by the owner to the prime contractor shall be subject to interest to be paid by the prime contractor to the subcontractor at the rate of one percent (1%) per month or fraction thereof.

d. Nothing in this section shall prevent the prime contractor at the time of application and certification to the owner from withholding application and certification to the owner for

payment to the subcontractor for unsatisfactory job progress; defective construction not remedied; disputed work; third-party claims filed or reasonable evidence that claim will be filed; failure of subcontractor to make timely payments for labor, equipment and materials; damage to prime contractor or another subcontractor; reasonable evidence that subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by owner.

ARTICLE 18 - DESIGNER'S STATUS

a. The designer shall provide general administration of the performance of construction contracts, including liaison and necessary inspection of the work to ensure compliance with plans and specifications. He is the agent of the owner only for the purpose of constructing this work and to the extent stipulated in the contract documents. He has authority to direct work to be performed, to stop work, to order work removed, or to order corrections of faulty work, where any such action by the designer may be necessary to assure successful completion of the work.

b. The designer is the impartial interpreter of the contract documents, and, as such, he shall exercise his powers under the contract to enforce faithful performance by both the owner and the contractor, taking sides with neither.

c. Should the designer cease to be employed on the work for any reason whatsoever, then the owner shall employ a competent replacement who shall assume the status of the former designer.

d. The designer and his consultants will make inspections of the project. He will inspect the progress, the quality and the quantity of the work.

e. The designer and the owner shall have access to the work whenever it is in preparation and progress during normal working hours. The contractor shall provide facilities for such access so the designer and owner may perform their functions under the contract documents.

f. Based on the designer's inspections and evaluations of the project, the designer shall issue interpretations, directives and decisions as may be necessary to administer the project. His decisions relating to artistic effect and technical matters shall be final, provided such decisions are within the limitations of the contract.

ARTICLE 19 - CHANGES IN THE WORK

a. The owner may have changes made in the work covered by the contract. These changes will not invalidate and will not relieve or release the contractor from any guarantee given by him pertinent to the contract provisions. These changes will not affect the validity of the guarantee bond and will not relieve the surety or sureties of said bond. All extra work shall be executed under conditions of the original contract.

b. Except in an emergency endangering life or property, no change shall be made by the contractor except upon receipt of approved change order or written field order from the designer, countersigned by the owner and the state construction office authorizing such change. No claim for adjustments of the contract price shall be valid unless this procedure is followed.

A field order, transmitted by fax, electronically, or hand delivered, may be used where the change involved impacts the critical path of the work. A formal change order shall be issued as expeditiously as possible.

In the event of emergency endangering life or property, the contractor may be directed to proceed on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the designer or owner, a correct account of costs together with all proper invoices, payrolls and supporting data. Upon completion of the work the change order will be prepared as outlined under either Method "c(1)" or Method "c(2)" or both.

c. In determining the values of changes, either additive or deductive, contractors are restricted to the use of the following methods:

1. Where the extra work involved is covered by unit prices quoted in the proposal, or subsequently agreed to by the Contractor, Designer, Owner and State Construction Office the value of the change shall be computed by application of unit prices based on quantities, estimated or actual as agreed of the items involved, except is such cases where a quantity exceeds the estimated quantity allowance in the contract by one hundred percent (100%) or more. In such cases, either party may elect to proceed under subparagraph c2 herein. If neither party elects to proceed under c2, then unit prices shall apply.

2. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the change order, and the change order shall stipulate the corresponding lump sum adjustment to the contract price.

d. Under Paragraph “b” and Methods "c(2)" above, the allowances for overhead and profit combined shall be as follows: all contractors (the single contracting entity (prime), his subcontractors(1st tier subs), or their sub-subcontractors (2nd tier subs, 3rd tier subs, etc)) shall be allowed a maximum of 10% on work they each self-perform; the prime contractor shall be allowed a maximum of 5% on contracted work of his 1st tier sub; 1st tier, 2nd tier, 3rd tier, etc contractors shall be allowed a maximum of 2.5% on the contracted workof their subs. ; Under Method "c(1)", no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under Method "c(2)" and Paragraph (b) above, the contractor shall include no less than five percent (5%) profit, but no allowances for overhead.

e. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:

1. The actual costs of materials and supplies incorporated or consumed as part of the work;

2. The actual costs of labor expended on the project site; labor expended in coordination, change order negotiation, record document maintenance, shop drawing revision or other tasks necessary to the administration of the project are considered overhead whether they take place in an office or on the project site.

3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker’s compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of

which shall not exceed thirty percent (30%) of the actual costs of labor;

4. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the work;

5. The actual costs of premiums for bonds, insurance, permit fees, and sales or use taxes related to the work.

6. Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the owner.

f. Should concealed conditions be encountered in the performance of the work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the contract documents, the contract sum and time for completion may be equitably adjusted by change order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods. All change orders shall be supported by a unit cost breakdown showing method of arriving at net cost as defined above.

g. In all change orders, the procedure will be for the designer to request proposals for the change order work in writing. The contractor will provide such proposal and supporting data in suitable format. The designer shall verify correctness. Delay in the processing of the change order due to lack of proper submittal by the contractor of all required supporting data shall not constitute grounds for a time extension or basis of a claim. Within fourteen (14) days after receipt of the contractor's accepted proposal including all supporting documentation required by the designer**,** the designer shall prepare the change order and forward to the contractor for his signature or otherwise respond, in writing, to the contractor's proposal. Within seven (7) days after receipt of the change order executed by the contractor, the designer shall certify the change order by his signature and forward the change order and all supporting data to the owner for the owner's signature. The owner shall execute the change order and forward to the State Construction Office for final approval**,** within seven (7) days of receipt. The State Construction Office shall act on the change order within seven (7) days. In case of emergency or extenuating circumstances, approval of changes may be obtained verbally by telephone or field orders approved by all parties, then shall be substantiated in writing as outlined under normal procedure.

h. At the time of signing a change order, the contractor shall be required to certify as follows:

"I certify that my bonding company will be notified forthwith that my contract has been changed by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety."

i. A change order, when issued, shall be full compensation, or credit, for the work included, omitted or substituted. It shall show on its face the adjustment in time for completion of the project as a result of the change in the work.

j. If, during the progress of the work, the owner requests a change order and the contractor's terms are unacceptable, the owner**,** with the approval of the State Construction Office, may require the contractor to perform such work on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the Designer or owner, a correct account of cost together with all proper invoices, payrolls and supporting data. Upon completion of the work a change order will be prepared with allowances for overhead and profit per paragraph d. above and "net

cost" and "cost" per paragraph e. above. Without prejudice, nothing in this paragraph shall preclude the owner from performing or to have performed that portion of the work requested in the change order.

ARTICLE 20 - CLAIMS FOR EXTRA COST

a. Should the contractor consider that as a result of instructions given by the designer, he is entitled to extra cost above that stated in the contract, he shall give written notice thereof to the designer within seven (7) days without delay. The written notice shall be a stand-alone document, shall clearly state that a claim for extra cost is being made, and shall provide a detailed justification for the extra cost. The contractor shall not proceed with the work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article 19(b) and Article 11(h). No claims for extra compensation shall be considered unless the claim is so made. The designer shall render a written decision within seven (7) days of receipt of claim.

b. The contractor shall not act on instructions received by him from persons other than the designer, and any claims for extra compensation or extension of time on account of such instruction will not be honored. The designer shall not be responsible for misunderstandings claimed by the contractor of verbal instructions which have not been confirmed in writing, and in no case shall instructions be interpreted as permitting a departure from the contract documents unless such instruction is confirmed in writing and supported by a properly authorized change order.

c. Should a claim for extra compensation that complies with the requirements of (a) above by the contractor and is denied by the designer or owner, and cannot be resolved by a representative of the State Construction Office, the contractor may request a mediation in connection with GS 143-128(f1) in the dispute resolution rules adopted by the State Building Commission (1 N.C.A.C. 30H .0101 through .1001). If the contractor is unable to resolve its claim as a result of mediation, the contractor may pursue the claim in accordance with the provisions of G.S. 143-135.3, or G.S. 143-135.6 where Community Colleges are the owner, and the following:

1. A contractor who has not completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The director may deny, allow or compromise the claim, in whole or in part. A claim under this subsection is not a contested case under Chapter 150B of the General Statutes.

2. A contractor who has completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The claim shall be submitted within sixty (60) days after the contractor receives a final statement of the board's disposition of his claim and shall state the factual basis for the claim.

   (a) The director shall investigate a submitted claim within ninety (90) days of receiving the claim, or within any longer time period upon which the director and the contractor agree. The contractor may appear before the director, either in person or through counsel, to present facts and arguments in support of his claim. The director may allow, deny or compromise the claim, in whole or in part. The director shall give the contractor a written statement

of the director's decision on the contractor's claim.

(b) A contractor who is dissatisfied with the director's decision on a claim submitted under this subsection may commence a contested case on the claim under Chapter 150B of the General Statutes. The contested case shall be commenced within sixty (60) days of receiving the director's written statement of the decision.

(c) As to any portion of a claim that is denied by the director, the contractor may, in lieu of the procedures set forth in the preceding subsection of this section, within six (6) months of receipt of the director's final decision, institute a civil action for the sum he claims to be entitled to under the contract by filing a verified complaint and the issuance of a summons in the Superior Court of Wake County or in the superior court of any county where the work under the contract was performed. The procedure shall be the same as in all civil actions except that all issues shall be tried by the judge, without a jury.

ARTICLE 21 - MINOR CHANGES IN THE WORK

The designer will have the authority to order minor changes in the work not involving an adjustment in the contract sum or time for completion, and not inconsistent with the intent of the contract documents. Such changes shall be effected by written order, copied to the State Construction Office, and shall be binding on the owner and the contractor.

ARTICLE 22 - UNCORRECTED FAULTY WORK

Should the correction of faulty or damaged work be considered inadvisable or inexpedient by the owner and the designer, the owner shall be reimbursed by the contractor. A change order will be issued to reflect a reduction in the contract sum.

ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSION OF TIME

a. The time of completion is stated in the Supplementary General Conditions and in the Form of Construction Contract. The Project Expediter, upon notice of award of contract, shall prepare a construction schedule to complete the project within the time of completion as required by Article 14.

b. The contractors shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed from the designer and shall fully complete all work hereunder within the time of completion stated. Time is of the essence and the contractor acknowledges the Owner will likely suffer financial damage for failure to complete the work within the time of completion. For each day in excess of the above number of days, the contractor(s) shall pay the owner the sum stated as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the owner by reason of failure of said contractor(s) to complete the work within the time specified, such time being in the essence of this contract and a material consideration thereof. Should the work be delayed by both the owner and contractor, liquidated damages shall be apportioned to reflect the delays of each party. In the case of concurrent delays, contractor caused delays shall be accounted for before owner and designer caused delays.

c. In the event of multiple prime contractors, the designer shall be the judge as to the

division of responsibility between the contractor(s), based on the construction schedule, weekly reports and job records, and shall apportion the amount of liquidated damages to be paid by each of them, according to delay caused by any or all of them.

d. If the contractor is delayed at any time in the progress of his work solely by any act or negligence of the owner, the designer, or by any employee of either; by any separate contractor employed by the owner; by changes ordered in the work; by labor disputes at the project site; by abnormal weather conditions not reasonably anticipated for the locality where the work is performed; by unavoidable casualties; by any causes beyond the contractor's control; or by any other causes which the designer and owner determine may justify the delay, then the contract time may be extended by change order only for the time which the designer and owner may determine is reasonable.

   Time extensions will not be granted for rain, wind, snow or other natural phenomena of normal intensity for the locality where work is performed. For purpose of determining extent of delay attributable to unusual weather phenomena, a determination shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climatic range during the same time interval based on the National Oceanic and Atmospheric Administration National Weather Service statistics for the locality where work is performed and on daily weather logs kept on the job site by the contractor reflecting the effect of the weather on progress of the work and initialed by the designer's representative. No weather delays shall be considered after the building is dried in unless work claimed to be delayed is on the critical path of the baseline schedule or approved updated schedule. Time extensions for weather delays, acts of God, labor disputes, fire, delays in transportation, unavoidable casualties or other delays which are beyond the control of the Owner do not entitle the Contractor to compensable damages for delays. Any contractor claim for compensable damages for delays is limited to delays caused solely by the owner or its agents. Contractor caused delays shall be accounted for before owner or designer caused delays in the case of concurrent delays.

e. Request for extension of time shall be made in writing to the designer, copies to the owner and SCO, within twenty (20) days following cause of delay. In case of continuing cause for delay, the Contractor shall notify the Designer to the designer, copies to the owner and SCO, of the delay within 20 days of the beginning of the delay and only one claim is necessary.

f. The contractor shall notify his surety in writing of extension of time granted.

g. No claim for time extension shall be allowed on account of failure of the designer to furnish drawings or instructions until twenty (20) days after demand for such drawings and/or instructions. See Article 5c. Demand must be in written form clearly stating the potential for delay unless the drawings or instructions are provided. Any delay granted will begin after the twenty (20) day demand period is concluded.

ARTICLE 24 - PARTIAL UTILIZATION/BENEFICIAL OCCUPANCY

a. The owner may desire to occupy or utilize all or a portion of the project prior to the completion of the project.

b. Should the owner request a utilization of a building or portion thereof, the designer shall perform a designer final inspection of area after being notified by the contractor that the area is ready for such. After the contractor has completed designer final inspection punch list and the designer has verified, then the designer shall schedule a beneficial occupancy inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office. If beneficial occupancy is granted by the State Construction Office,

in such areas the following will be established:

1. The beginning of guarantees and warranties period for the equipment necessary to support. in the area.

2. The owner assumes all responsibilities for utility costs for entire building.

2. Contractor will obtain consent of surety.

3. Contractor will obtain endorsement from insurance company permitting beneficial occupancy.

c. The owner shall have the right to exclude the contractor from any part of the project which the designer has so certified to be substantially complete, but the owner will allow the contractor reasonable access to complete or correct work to bring it into compliance with the contract.

d. Occupancy by the owner under this article will in no way relieve the contractor from his contractual requirement to complete the project within the specified time. The contractor will not be relieved of liquidated damages because of beneficial occupancy. The designer may prorate liquidated damages based on the percentage of project occupied.

ARTICLE 25 - FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT

a. Upon notification from the contractor(s) that the project is complete and ready for inspection, the designer shall make a Designer final inspection to verify that the project is complete and ready for SCO final inspection. Prior to SCO final inspection, the contractor(s) shall complete all items requiring corrective measures noted at the Designer final inspection. The designer shall schedule a SCO final inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office.

b. At the SCO final inspection, the designer and his consultants shall, if job conditions warrant, record a list of items that are found to be incomplete or not in accordance with the contract documents. At the conclusion of the SCO final inspection, the designer and State Construction Office representative shall make one of the following determinations:

1. That the project is completed and accepted.

2. That the project will be accepted subject to the correction of the list of discrepancies (punch list). All punch list items must be completed within thirty (30) days of SCO final inspection or the owner may invoke Article 28, Owner's Right to Do Work.

4. That the project is not complete and another date for a SCO final inspection will be established.

c. Within fourteen (14) days of final acceptance per Paragraph b1 or within fourteen (14) days after completion of punch list per Paragraph b2 above, the designer shall certify the work and issue applicable certificate(s) of compliance.

d. Any discrepancies listed or discovered after the date of SCO final inspection and acceptance under Paragraphs b1 or b2 above shall be handled in accordance with Article 42, Guarantee.

f. The final acceptance date will establish the following:

1. The beginning of guarantees and warranties period.

2. The date on which the contractor's insurance coverage for public liability, property damage and builder's risk may be terminated.

3. That no liquidated damages (if applicable) shall be assessed after this date.

4. The termination date of utility cost to the contractor.

g. Prior to issuance of final acceptance date, the contractor shall have his authorized representatives visit the project and give full instructions to the designated personnel regarding operating, maintenance, care, and adjustment of all equipment and special construction elements. In addition, the contractor shall provide to the owner a complete instructional video (media format acceptable to the owner) on the operation, maintenance, care and adjustment of all equipment and special construction elements.

ARTICLE 26 - CORRECTION OF WORK BEFORE FINAL PAYMENT

a. Any work, materials, fabricated items or other parts of the work which have been condemned or declared not in accordance with the contract by the designer shall be promptly removed from the work site by the contractor, and shall be immediately replaced by new work in accordance with the contract at no additional cost to the owner. Work or property of other contractors or the owner, damaged or destroyed by virtue of such faulty work, shall be made good at the expense of the contractor whose work is faulty.

b. Correction of condemned work described above shall commence within twenty-four (24) hours after receipt of notice from the designer, and shall make satisfactory progress, as determined by the designer, until completed.

c. Should the contractor fail to proceed with the required corrections, then the owner may complete the work in accordance with the provisions of Article 28.

ARTICLE 27 - CORRECTION OF WORK AFTER FINAL PAYMENT

See Article 35, Performance Bond and Payment Bond, and Article 42, Guarantee**.** Neither the final certificate, final payment, occupancy of the premises by the owner, nor any provision of the contract, nor any other act or instrument of the owner, nor the designer, shall relieve the contractor from responsibility for negligence, or faulty material or workmanship, or failure to comply with the drawings and specifications. Contractor shall correct or make good any defects due thereto and repair any damage resulting there from, which may appear during the guarantee period following final acceptance of the work except as stated otherwise under Article 42, Guarantee. The owner will report any defects as they may appear to the contractor and establish a time limit for completion of corrections by the contractor. The owner will be the judge as to the responsibility for correction of defects.

ARTICLE 28 - OWNER'S RIGHT TO DO WORK

If, during the progress of the work or during the period of guarantee, the contractor fails to prosecute the work properly or to perform any provision of the contract, the owner, after seven (7) days' written notice sent by certified mail, return receipt requested, to the contractor

from the designer, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the contractor, such action and cost of same having been first approved by the designer. Should the cost of such action of the owner exceed the amount due or to become due the contractor, then the contractor or his surety, or both, shall be liable for and shall pay to the owner the amount of said excess.

ARTICLE 29 - ANNULMENT OF CONTRACT

If the contractor fails to begin the work under the contract within the time specified, or the progress of the work is not maintained on schedule, or the work is not completed within the time above specified, or fails to perform the work with sufficient workmen and equipment or with sufficient materials to ensure the prompt completion of said work, or shall perform the work unsuitably or shall discontinue the prosecution of the work, or if the contractor shall become insolvent or be declared bankrupt or commit any act of bankruptcy or insolvency, or allow any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours, or shall make an assignment for the benefit of creditors, or for any other cause whatsoever shall not carry on the work in an acceptable manner, the owner may give notice in writing, sent by certified mail, return receipt requested, to the contractor and his surety of such delay, neglect or default, specifying the same, and if the contractor within a period of seven (7) days after such notice shall not proceed in accordance therewith, then the owner shall, declare this contract in default, and, thereupon, the surety shall promptly take over the work and complete the performance of this contract in the manner and within the time frame specified. In the event the surety shall fail to take over the work to be done under this contract within seven (7) days after being so notified and notify the owner in writing, sent by certified mail, return receipt requested, that he is taking the same over and stating that he will diligently pursue and complete the same, the owner shall have full power and authority, without violating the contract, to take the prosecution of the work out of the hands of said contractor, to appropriate or use any or all contract materials and equipment on the grounds as may be suitable and acceptable and may enter into an agreement, either by public letting or negotiation, for the completion of said contract according to the terms and provisions thereof or use such other methods as in his opinion shall be required for the completion of said contract in an acceptable manner. All costs and charges incurred by the owner, together with the costs of completing the work under contract, shall be deducted from any monies due or which may become due said contractor and surety. In case the expense so incurred by the owner shall be less than the sum which would have been payable under the contract, if it had been completed by said contractor, then the said contractor and surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the contract, then the contractor and the surety shall be liable and shall pay to the owner the amount of said excess.

ARTICLE 30 - CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT

a. Should the work be stopped by order of a court having jurisdiction, or by order of any other public authority for a period of three months, due to cause beyond the fault or control of the contractor, or if the owner should fail or refuse to make payment on account of a certificate issued by the designer within forty-five (45) days after receipt of same, then the contractor, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the owner and the designer, may suspend operations on the work or terminate the contract.

b. The owner shall be liable to the contractor for the cost of all materials delivered and work performed on this contract plus 10 percent overhead and profit and shall make such

payment. The designer shall be the judge as to the correctness of such payment.

ARTICLE 31 - REQUEST FOR PAYMENT

a. Not later than the fifth day of the month, the contractor shall submit to the designer a request for payment for work done during the previous month. The request shall be in the form agreed upon between the contractor and the designer, but shall show substantially the value of work done and materials delivered to the site during the period since the last payment, and shall sum up the financial status of the contract with the following information:

   1. Total of contract including change orders.

   2. Value of work completed to date.

   3. Less five percent (5%) retainage, provided however, that after fifty percent (50%) of the contractor's work has been satisfactorily completed on schedule, with approval of the owner and the State Construction Office and written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule.

   4. Less previous payments.

   5. Current amount due.

b. The contractor, upon request of the designer, shall substantiate the request with invoices of vouchers or payrolls or other evidence.

c. Prior to submitting the first request, the contractor shall prepare for the designer a schedule showing a breakdown of the contract price into values of the various parts of the work, so arranged as to facilitate payments to subcontractors in accordance with Article 17, Contractor and Subcontractor Relationships. The contractor(s) shall list the value of each subcontractor and supplier, identifying each minority business subcontractor and supplier as listed in Affidavit C, if applicable.

d. When payment is made on account of stored materials and equipment, such materials must be stored on the owner's property, and the requests for payments shall be accompanied by invoices or bills of sale or other evidence to establish the owner's title to such materials and equipment. Such payments will be made only for materials that have been customized or fabricated specifically for this project. Raw materials or commodity products including but not limited to piping, conduit, CMU, metal studs and gypsum board may not be submitted. Responsibility for such stored materials and equipment shall remain with the contractor regardless of ownership title. Such stored materials and equipment shall not be removed from the owner's property. Should the space for storage on-site be limited, the contractor, at his option, shall be permitted to store such materials and/or equipment in a suitable space off-site. Should the contractor desire to include any such materials or equipment in his application for payment, they must be stored in the name of the owner in an independent, licensed, bonded warehouse approved by the designer, owner and the State Construction Office and located as close to the site as possible. The warehouse selected must be approved by the contractor's bonding and insurance companies; the material to be paid for shall be assigned to the owner and shall be inspected by the designer. Upon approval by the designer, owner and SCO of the storage facilities and materials and equipment, payment therefore will be certified. Responsibility for such stored materials and equipment shall remain with the contractor.

Such stored materials and equipment shall not be moved except for transportation to the project site. Under certain conditions, the designer may approve storage of materials at the point of manufacture, which conditions shall be approved by the designer, the owner and the State Construction Office prior to approval for the storage and shall include an agreement by the storing party which unconditionally gives the State absolute right to possession of the materials at anytime. Bond, security and insurance protection shall continue to be the responsibility of the contractor(s).

e. In the event of beneficial occupancy, retainage of funds due the contractor(s) may be reduced with the approval of the State Construction Office to an equitable amount to cover the list of items to be completed or corrected. Retainage may not be reduced to less than two and one-half (2 1/2) times the estimated value of the work to be completed or corrected. Reduction of retainage must be with the consent and approval of the contractor's bonding company.

ARTICLE 32 - CERTIFICATES OF PAYMENT AND FINAL PAYMENT

a. Within five (5) days from receipt of request for payment from the contractor, the designer shall issue and forward to the owner a certificate for payment. This certificate shall indicate the amount requested or as approved by the designer. If the certificate is not approved by the designer, he shall state in writing to the contractor and the owner his reasons for withholding payment.

b. No certificate issued or payment made shall constitute an acceptance of the work or any part thereof. The making and acceptance of final payment shall constitute a waiver of all claims by the owner except:

1. Claims arising from unsettled liens or claims against the contractor.

2. Faulty work or materials appearing after final payment.

3. Failure of the contractor to perform the work in accordance with drawings and specifications, such failure appearing after payment.

4. As conditioned in the performance bond and payment bond.

c. The making and acceptance of final payment shall constitute a waiver of all claims by the contractor except those claims previously made and remaining unsettled (Article 20(c)).

d. Prior to submitting request for final payment to the designer for approval, the contractor shall fully comply with all requirements specified in the “project closeout” section of the specifications. These requirements include but are not limited to the following:

1. Submittal of Product and Operating Manuals, Warranties and Bonds, Guarantees, Maintenance Agreements, As-Built Drawings, Certificates of Inspection or Approval from agencies having jurisdiction. (The designer must approve the Manuals prior to delivery to the owner).

2. Transfer of required attic stock material and all keys in an organized manner.

3. Record of Owner’s training.

4. Resolution of any final inspection discrepancies.

5. Granting access to Contractor’s records, if the State Auditor, the Owner’s internal

auditors, or the Joint Legislative Commission on Governmental Operations have made a request for such access pursuant to Article 52.

e. The contractor shall forward to the designer, the final application for payment along with the following documents:

1. List of minority business subcontractors and material suppliers showing breakdown of contract amounts and total actual payments to subs and material suppliers.

2. Affidavit of Release of Liens.

3. Affidavit of contractors of payment to material suppliers and subcontractors. (See Article 36).

4. Consent of Surety to Final Payment.

5. Certificates of state agencies required by state law.

f. The designer will not authorize final payment until the work under contract has been certified by designer, certificates of compliance issued, and the contractor has complied with the closeout requirements. The designer shall forward the contractor's final application for payment to the owner along with respective certificate(s) of compliance required by law.

ARTICLE 33 - PAYMENTS WITHHELD

a. The designer with the approval of the State Construction Office may withhold payment for the following reasons:

1. Faulty work not corrected.
2. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.

3. To provide for sufficient contract balance to cover liquidated damages that will be assessed.

b. The secretary of the Department of Administration may authorize the withholding of payment for the following reasons:

1. Claims filed against the contractor or evidence that a claim will be filed.

2. Evidence that subcontractors have not been paid.

c. The Owner may withhold all or a portion of Contractor's general conditions costs set forth in the approved schedule of values, if Contractor has failed to comply with: (1) a request to access its records by the State Auditor, the Owner's internal auditors, or the Joint Legislative Commission on Governmental Operations pursuant to Article 52; (2) a request for a plan of action and/or recovery schedule under Article 14.j or provide The Owner; (3) a request to provide an electronic copies of Contractor's baseline schedule, updates with all logic used to create the schedules in the original format of the scheduling software; and (4) Contractor's failure to have its Superintendent on the Project full-time.

d. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the contractor without cause will make owner liable for payment

of interest to the contractor in accordance with G.S. 143-134.1. As provided in G.S.143-134.1(e) the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progress, defective construction not remedied, disputed work, or third- party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS

The work under this contract shall not commence until all required insurance and verifying certificates of insurance have been obtained by the Contractor and documentation has been approved in writing by the Owner. A cancellation endorsement shall be provided for all required policies that contains a provision that coverages afforded under the policy will not be cancelled, reduced in amount or coverages eliminated until at least thirty (30) days after giving written notice, has been delivered or mailed to the insured and the Owner, of such alteration or cancellation.

a. **Worker's Compensation and Employer's Liability**

The contractor shall provide and maintain, until final acceptance, workmen's compensation insurance, as required by law, as well as employer's liability coverage with minimum limits of $100,000.

b. **Public Liability and Property Damage**

The contractor shall provide and maintain, until final acceptance, comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property damages which may arise from operations under this contract, whether such operations be by the contractor or by any subcontractor, or by anyone directly or indirectly employed by either of them and the minimum limits of such insurance shall be as follows:

Bodily Injury:	$500,000 per occurrence
Property Damage:	$100,000 per occurrence / $300,000 aggregate

In lieu of limits listed above, a $500,000 combined single limit shall satisfy both conditions.

Such coverage for completed operations must be maintained for at least two (2) years following final acceptance of the work performed under the contract.

c. **Property Insurance (Builder's Risk/Installation Floater)**

The contractor shall purchase and maintain property insurance until final acceptance, upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the owner, the contractor, the subcontractors and sub-subcontractors in the work and shall insure against the perils of fire, wind, rain, flood, extended coverage, and vandalism and malicious mischief. If the owner is damaged by failure of the contractor to purchase or maintain such insurance, then the contractor shall bear all reasonable costs properly attributable thereto; the contractor shall effect and maintain similar property insurance on portions of the work stored off the site when request for payment per articles so includes such portions.

d. **Deductible**

Any deductible, if applicable to loss covered by insurance provided, is to be borne by the contractor.

e. **Other Insurance**

The contractor shall obtain such additional insurance as may be required by the owner or by the General Statutes of North Carolina including motor vehicle insurance, in amounts not less than the statutory limits.

f. **Proof of Carriage**

The contractor shall furnish the owner with satisfactory proof of carriage of the insurance required before written approval is granted by the owner.

ARTICLE 35 - PERFORMANCE BOND AND PAYMENT BOND

a. Each contractor shall furnish a performance bond and payment bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form bound with these specifications.

b. All bonds shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

ARTICLE 36 - CONTRACTOR'S AFFIDAVIT

The final payment of retained amount due the contractor on account of the contract shall not become due until the contractor has furnished to the owner through the designer an affidavit signed, sworn and notarized to the effect that all payments for materials, services or subcontracted work in connection with his contract have been satisfied, and that no claims or liens exist against the contractor in connection with this contract. In the event that the contractor cannot obtain similar affidavits from subcontractors to protect the contractor and the owner from possible liens or claims against the subcontractor, the contractor shall state in his affidavit that no claims or liens exist against any subcontractor to the best of his (the contractor's) knowledge, and if any appear afterward, the contractor shall save the owner harmless.

ARTICLE 37 - ASSIGNMENTS

The contractor shall not assign any portion of this contract nor subcontract in its entirety. Except as may be required under terms of the performance bond or payment bond, no funds or sums of money due or become due the contractor under the contract may be assigned.

ARTICLE 38 - USE OF PREMISES

a. The contractor(s) shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the

designer and owner and shall not exceed those established limits in his operations.

b. The contractor(s) shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.

c. The contractor(s) shall enforce the designer's and owner's instructions regarding signs, advertisements, fires and smoking.

d. No firearms, any type of alcoholic beverages, or drugs (other than those prescribed by a physician) will be permitted at the job site.

ARTICLE 39 - CUTTING, PATCHING AND DIGGING

a. The contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other contractors shown upon or reasonably implied by the drawings and specifications for the completed structure, as the designer may direct.

b. Any cost brought about by defective or ill-timed work shall be borne by the party responsible therefor.

c. No contractor shall endanger any work of another contractor by cutting, digging or other means. No contractor shall cut or alter the work of any other contractor without the consent of the designer and the affected contractor(s).

ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS

a. The contractor shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer and other utility services which maybe necessary and required for completion of the project including all utilities required for testing, cleaning, balancing, and sterilization of designated plumbing, mechanical and electrical systems. Any permanent meters installed shall be listed in the contractor's name until work has a final acceptance. The contractor will be solely responsible for all utility costs prior to final acceptance. Contractor shall contact all affected utility companies prior to bid to determine their requirements to provide temporary and permanent service and include all costs associated with providing those services in their bid. Coordination of the work of the utility companies during construction is the sole responsibility of the contractor.

b. Meters shall be relisted in the owner's name on the day following final acceptance of the Project Expediter's work, and the owner shall pay for services used after that date.

c. The owner shall be reimbursed for all metered utility charges after the meter is relisted in the owner's name and prior to completion and acceptance of the work of all contractors. Reimbursement shall be made by the contractor whose work has not been completed and accepted. If the work of two or more contractors has not been completed and accepted, reimbursement to the owner shall be paid by the contractors involved on the basis of assessments by the designer.

d Prior to the operation of permanent systems, the Project Expediter will provide temporary power, lighting, water, and heat to maintain space temperature above freezing, as required for construction operations.

e. All contractors shall have the permanent building systems in sufficient readiness for

furnishing temporary climatic control at the time a building is enclosed and secured. The HVAC systems shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishes of the building. A building shall be considered enclosed and secured when windows**,** doorways (exterior, mechanical, and electrical equipment rooms), and hardware are installed**;** and other openings have protection which will provide reasonable climatic control. The appropriate time to start the mechanical systems and climatic condition shall be jointly determined by the contractor(s), the designer and owner. Use of the equipment in this manner shall be subject to the approval of the Designer and owner and shall in no way affect the warranty requirements of the contractor(s).

f. The electrical contractor shall have the building's permanent power wiring distribution system in sufficient readiness to provide power as required by the HVAC contractor for temporary climatic control.

g. The electrical contractor shall have the building's permanent lighting system ready at the time the general contractor begins interior painting and shall provide adequate lighting in those areas where interior painting and finishing is being performed.

h. Each prime contractor shall be responsible for his permanently fixed service facilities and systems in use during progress of the work. The following procedures shall be strictly adhered to:

1. Prior to final acceptance of work by the State Construction Office, each contractor shall remove and replace any parts of the permanent building systems damaged through use during construction.

2. Temporary filters as recommended by the equipment manufacturer in order to keep the equipment and ductwork clean and free of dust and debris shall be installed in each of the heating and air conditioning units and at each return grille during construction. New filters shall be installed in each unit prior to the owner's acceptance of the work.

3. Extra effort shall be maintained to keep the building and the site adjacent to the building clean and under no circumstances shall air systems be operated if finishing and site work operations are creating dust in excess of what would be considered normal if the building were occupied.

4. It shall be understood that any warranty on equipment presented to the owner shall extend from the day of final acceptance by the owner. The cost of warranting the equipment during operation in the finishing stages of construction shall be borne by the contractor whose system is utilized.

5. The electrical contractor shall have all lamps in proper working condition at the time of final project acceptance.

i. The Project Expediter shall provide, if required and where directed, a shed for toilet facilities and shall furnish and install in this shed all water closets required for a complete and adequate sanitary arrangement. These facilities will be available to other contractors on the job and shall be kept in a neat and sanitary condition at all times. Chemical toilets are acceptable.

j. The Project Expediter shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the

use of a resident inspector, should the designer so direct.

k. On multi-story construction projects, the Project Expediter shall provide temporary elevators, lifts, or other special equipment for the general use of all contractors. The cost for such elevators, lifts or other special equipment and the operation thereof shall be included in the Project Expediter's bid.

l. The Project Expediter will erect one sign on the project if required. The sign shall be of sound construction, and shall be neatly lettered with black letters on white background. The sign shall bear the name of the project, and the names of prime contractors on the project, and the name of the designer and consultants. Directional signs may be erected on the owner's property subject to approval of the owner with respect to size, style and location of such directional signs. Such signs may bear the name of the contractor and a directional symbol. No other signs will be permitted except by permission of the owner.

ARTICLE 41 - CLEANING UP

a. The contractors shall keep the building and surrounding area reasonably free from rubbish at all times, and shall remove debris from the site on a timely basis or when directed to do so by the designer or Project Expediter. The Project Expediter shall provide an on site refuse container(s) for the use of all contractors. Each contractor shall remove their rubbish and debris from the building on a daily basis. The Project Expediter shall broom clean the building as required to minimize dust and dirt accumulation.

b. The Project Expediter shall provide and maintain suitable all-weather access to the building.

c. Before final inspection and acceptance of the building, each contractor shall clean his portion of the work, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the owner, with no cleaning required by the owner.

ARTICLE 42 - GUARANTEE

a. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the date of final acceptance of the work or beneficial occupancy and shall replace such defective materials or workmanship without cost to the owner.

b. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturer's warranty period.

c. Additionally, the owner may bring an action for latent defects caused by the negligence of the contractor which is hidden or not readily apparent to the owner at the time of beneficial occupancy or final acceptance, whichever occurred first, in accordance with applicable law.

d. Guarantees for roof, equipment, materials, and supplies shall be stipulated in the specifications sections governing such roof, equipment, materials, or supplies.

ARTICLE 43 - CODES AND STANDARDS

Wherever reference is given to codes, standard specifications or other data published by regulating agencies including, but not limited to, national electrical codes, North Carolina state building codes, federal specifications, ASTM specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda published prior to the date of the contract documents.

ARTICLE 44 - INDEMNIFICATION

To the fullest extent permitted by law, the contractor shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance or failure of performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting there from, and (2) is caused in whole or in part by any negligent act or omission of the contractor, the contractor's subcontractor, or the agents of either the contractor or the contractor's subcontractor. Such obligation shall not be construed to negate, abridge or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this article.

ARTICLE 45 - TAXES

a. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).

b. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).

c. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and contract sum.

d. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal and contract sum.

e. Accounting Procedures for Refund of County Sales & Use Tax

Amount of county sales and use tax paid per contractor's statements:

Contractors performing contracts for state agencies shall give the state agency for whose project the property was purchased a signed statement containing the information listed in G.S. 105-164.14(e).

The Department of Revenue has agreed that in lieu of obtaining copies of sales receipts from contractors, an agency may obtain a certified statement as of April 1, 1991 from the contractor setting forth the date, the type of property and the cost of the property purchased from each vendor, the county in which the vendor made the sale and the amount of local sales and use taxes paid thereon. If the property was purchased out-of-state, the county in which the property was delivered should be listed. The contractor

should also be notified that the certified statement may be subject to audit.

In the event the contractors make several purchases from the same vendor, such certified statement must indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices, the counties, and the county sales and use taxes paid thereon.

Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.

When property is purchased from out-of-state vendors and the county tax is charged, the county should be identified where delivery is made when reporting the county tax.

Such statement must also include the cost of any tangible personal property withdrawn from the contractor's warehouse stock and the amount of county sales or use tax paid thereon by the contractor.

Similar certified statements by his subcontractors must be obtained by the general contractor and furnished to the claimant.

Contractors are not to include any tax paid on supplies, tools and equipment which they use to perform their contracts and should include only those building materials, supplies, fixtures and equipment which actually become a part of or annexed to the building or structure.

ARTICLE 46 - EQUAL OPPORTUNITY CLAUSE

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to equal employment opportunity for all persons without regard to race, color, religion, sex or national origin, and the implementing rules and regulations prescribed by the secretary of Labor, are incorporated herein.

ARTICLE 47 - EMPLOYMENT OF INDIVIDUALS WITH DISABILITIES

The contractor(s) agree not to discriminate against any employee or applicant for employment because of physical or mental disabilities in regard to any position for which the employee or applicant is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified individuals with such disabilities without discrimination based upon their physical or mental disability in all employment practices.

ARTICLE 48 - ASBESTOS-CONTAINING MATERIALS (ACM)

The State of North Carolina has attempted to address all asbestos-containing materials that are to be disturbed in the project. However, there may be other asbestos-containing materials in the work areas that are not to be disturbed and do not create an exposure hazard. Contractors are reminded of the requirements of instructions under Instructions to Bidders and General Conditions of the Contract, titled Examination of Conditions. Statute 130A, Article 19, amended August 3, 1989, established the Asbestos Hazard Management Program that controls asbestos abatement in North Carolina. The latest edition of *Guideline Criteria for Asbestos*

Abatement from the State Construction Office is to be incorporated in all asbestos abatement projects for the Capital Improvement Program.

ARTICLE 49 - MINORITY BUSINESS PARTICIPATION

GS 143-128.2 establishes a ten percent (10%) goal for participation by minority businesses in total value of work for each State building project. The document, *Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts* including Affidavits and Appendix E are hereby incorporated into and made a part of this contract.

ARTICLE 50 – CONTRACTOR EVALUATION

The contractor's overall work performance on the project shall be fairly evaluated in accordance with the State Building Commission policy and procedures, for determining qualifications to bid on future State capital improvement projects. In addition to final evaluation, interim evaluation may be prepared during the progress of project. The document, Contractor Evaluation Procedures, is hereby incorporated and made a part of this contract. The owner may request the contractor's comments to evaluate the designer.

ARTICLE 51 – GIFTS

Pursuant to N.C. Gen. Stat. § 133-32, it is unlawful for any vendor or contractor (i.e. architect, bidder, contractor, construction manager, design professional, engineer, subcontractor, supplier, vendor, etc.), to make gifts or to give favors to any State employee. This prohibition covers those vendors and contractors who: (1) have a contract with a governmental agency; or (2) have performed under such a contract within the past year; or (3) anticipate bidding on such a contract in the future. For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review G.S. Sec. 133-32.

During the construction of the Project, the Contractor is prohibited from making gifts to any of the Owner's employees, Owner's project representatives (architect, engineers, construction manager and their employees), employees of the State Construction Office and/or any other State employee that may have any involvement, influence, responsibilities, oversight, management and/or duties that pertain to and/or relate to the contract administration, financial administration and/or disposition of claims arising from and/or relating to the Contract and/or Project.

ARTICLE 52 – AUDITING-ACCESS TO PERSONS AND RECORDS

a. In accordance with N.C. General Statute 147-64.7, the State Auditor shall have access to Contractor's officers, employees, agents and/or other persons in control of and/or responsible for the Contractor's records that relate to this Contracts for purposes of conducting audits under the referenced statute. The Owner's internal auditors shall also have the right to access and copy the Contractor's records relating to the Contract and Project during the term of the Contract and within two years following the completion of the Project/close-out of the Contract to verify accounts, accuracy, information, calculations and/or data affecting and/or relating to Contractor's requests for payment, requests for change orders, change orders, claims for extra work, requests for time

extensions and related claims for delay/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, passthrough claims of subcontractors and/or suppliers, and/or any other type of claim for payment or damages from Owner and/or its project representatives.

b. The following entities may audit the records of this contract during and after the term of the contract to verify accounts and data affecting fees or performance:

1. The State Auditor.

2. The internal auditors of the affected department, agency or institution.

3. The Joint Legislative Commission on Governmental Operations and legislative employees whose primary responsibility is to provide professional or administrative services to the Commission.

c. The Joint Legislative Commission on Governmental Operations has the authority to:

1. Study the efficiency, economy and effectiveness of any non-State entity receiving public funds.

2. Evaluate the implementation of public policies, as articulated by enacted law, administrative rule, executive order, policy, or local ordinance, by any non-State entity receiving public funds.

3. Investigate possible instances of misfeasance, malfeasance, nonfeasance, mismanagement, waste, abuse, or illegal conduct by officers and employees of a non-State entity receiving, directly or indirectly, public funds, as it relates to the officer's or employee's responsibilities regarding the receipt of public funds.

4. Receive reports as required by law or as requested by the Commission.

5. Access and review:

(a) Any documents or records related to any contract awarded by a State agency, including the documents and records of the contractor, that the Commission determines will assist in verifying accounts or will contain data affecting fees or performance; and

(b) Any records related to any subcontract of a contract awarded by a State agency that is utilized to fulfill the contract, including, but not limited to (i) records related to the drafting and approval of the subcontract, and (ii) documents and records of the contractor or subcontractor that the Commission determines will assist in verifying accounts or will contain data affecting fees or performance.

d. The Joint Legislative Commission on Governmental Operations has the power to:

1. Compel access to any document or system of records held by a non-State entity receiving, directly or indirectly, public funds, to the extent the documents relate to the receipt, purpose or implementation of a program or service paid for with public funds.

2. Compel attendance of any officer or employee of any non-State entity receiving public funds, provided the officer or employee is responsible for implementing a program or providing a service paid for with public funds.

e. Unless prohibited by federal law, the Commission and Commission staff in the discharge of their duties under this Article shall be provided access to any building or facility owned or leased by a non-State entity receiving public funds provided (i) the building or facility is used to implement a program or provide a service paid for with public funds and (ii) the access is reasonably related to the receipt, purpose, or implementation of a program or service paid for with public funds.

f. Any confidential information obtained by the Commission shall remain confidential and is not a public record as defined in G.S. 132-1.

g. Any document or information obtained or produced by Commission staff in furtherance of staff's duties to the Commission is confidential and is not a public record as defined in G.S. 132-1.

h. A person who conceals, falsifies, or refuses to provide to the Commission any document, information, or access to any building or facility as required by this Article with the intent to mislead, impede, or interfere with the Commission's discharge of its duties under this Article shall be guilty of a Class 2 misdemeanor.

ARTICLE 53 – NORTH CAROLINA FALSE CLAIMS ACT

The North Carolina False Claims Act ("NCFCA"), N.C Gen. Stat. § 1-605 through 1-618, applies to this Contract. The Contractor should familiarize itself with the entire NCFCA and should seek the assistance of an attorney if it has any questions regarding the NCFCA and its applicability to any requests, demands and/or claims for payment it submits to the State through the contracting state agency, institution, university or community college.

The purpose of the NCFCA "is to deter persons from knowingly causing or assisting in causing the State to pay claims that are false or fraudulent and to provide remedies in the form of treble damages and civil penalties when money is obtained from the State by reason of a false or fraudulent claim." (Section 1-605(b).) A contractor's liability under the NCFCA may arise from, but is not limited to: requests for payment, invoices, billing, claims for extra work, requests for change orders, requests for time extensions, claims for delay damages/extended general conditions costs, claims for loss productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, documentation used to support any of the foregoing requests or claims, and/or any other request for payment from the State through the contracting state agency, institution, university or community college. The parts of the NCFCA that are most likely to be enforced with respect to this type of contract are as follows:

6. A "claim" is "[a]ny request or demand, whether under a contract or otherwise, for money or property and whether or not the State has title to the money or property that is presented to an officer, employee, or agent of the State or (ii) is made to a contractor … if the money or property is to be spent or used on the State's behalf or to advance a State program or interest and if the State government: (a) provides or has provided any portion of the money or property that is requested or demanded; or (b) will reimburse such contractor … for any portion of the money or property which is requested or demanded." (Section 1-606(2).)

- "Knowing" and "knowingly." – Whenever a person, with respect to information, does any of the following: (a) Has actual knowledge of the information; (b) Acts in deliberate ignorance of the truth or falsity of the information; and/or (c) Acts in reckless disregard of the truth or falsity of the information. (Section 1-606(4).) Proof of specific intent to defraud is not required. (Section 1-606(4).)

- "Material" means having a natural tendency to influence, or be capable of influencing, the payment or receipt of money or property. (Section 1-606(4).)

- Liability. – "Any person who commits any of the following acts shall be liable to the State for three times the amount of damages that the State sustains because of the act of that person[:] … (1) Knowingly presents or causes to be presented a false or fraudulent claim for payment or approval. (2) Knowingly makes, uses, or causes to be made or used, a false record or statement material to a false or fraudulent claim. (3) Conspires to commit a violation of subdivision (1), (2) …" (Section 1-607(a)(1), (2).)
- The NCFCA shall be interpreted and construed so as to be consistent with the federal False Claims Act, 31 U.S.C. § 3729, et seq., and any subsequent amendments to that act. (Section 1-616(c).)

  Finally, the contracting state agency, institution, university or community college may refer any suspected violation of the NCFCA by the Contractor to the Attorney General's Office for investigation. Under Section 1-608(a), the Attorney General is responsible for investigating any violation of NCFCA, and may bring a civil action against the Contractor under the NCFCA. The Attorney General's investigation and any civil action relating thereto are independent and not subject to any dispute resolution provision set forth in this Contract. (See Section 1-608(a).)

ARTICLE 54 – TERMINATION FOR CONVENIENCE

Owner may at any time and for any reason terminate Contractor's services and work at Owner's convenience. Upon receipt of such notice, Contractor shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.

Upon such termination, Contractor shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by Contractor as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to Contractor prior to the date of the termination of this Agreement. Contractor shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment.

SUPPLEMENTARY GENERAL CONDITIONS

SUPPLEMENTS

The following supplements added to the "Instructions to Bidders and General Conditions of the Contract" of the Division of State Construction, North Carolina Department of Administration, Twenty Fourth Edition January 2013. Where any article of the General Conditions is modified by these supplements, the unaltered provisions of that Article, Paragraph, Subparagraph or Class shall remain in effect.

Article 1

i. The project expediter shall be the General Contractor.

Article 3

b. Add "Each (prime) Contractor shall review plans, specifications, project conditions, and all product supplier schedules at earliest possible date. If after review, clarifications and detail drawings are required, the clarifications schedule stated herein shall be formulated so as not to delay project."

Article 8

e. Add: "The above referenced list shall specifically note which products are requested substitutions. Review of substitutions by Designer shall require twenty (20) calendar days after receipt from Contractor. If Contractor can not meet project schedule deadlines with this 20 calendar day delay, then substitutions shall not be requested.

Article 11

b. Add: "Contractor shall take all necessary measures to protect all existing construction and finishes. All finishes and/or construction damaged by the Contractor shall be replaced or repaired to new condition at Contractors expense and within project schedule."

d. Add: "Contractor shall protect existing grassed areas. Where existing grass, trees, or shrubs are damaged, by Contractor, they shall be replaced at Contractors expense with landscape materials to match existing in size and type.

Article 14

a. Add; The Project Superintent shall be a direct employee of the General Contractor.

e. Contractor shall engage a qualified Land Surveyor Licensed in North Carolina to layout buildings and parking.

Article 16

a. Change "Thirty (30) days" to "Twenty (20) days".

Add: "Compliance with provisions of this Article shall not relieve Contractor of compliance with provisions of Article 23".

Article 23

a. Add: "1. The Contractor shall be issued a Notice to Proceed under this agreement on a date to be specified in a written order from the Designer and shall fully complete all work hereunder within 270 consecutive calendar for Base Bid days from said date. Additional days and conditions for days related to the acceptance of Alternate Bid items or Unit Prices are described in the Contract Documents.For each day in excess of the above number of days, the Contractor(s) shall pay to the Owner the sum of FIVE HUNDRED DOLLARS ($500.00) as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner by reason of failure of said Contractor(s) to complete the work within the time specified, such time being in the essence of this contract and material consideration thereof.

Article 34

Modify Paragraph C as follows:

"The contractor shall purchase and maintain property insurance during the life of this contract, upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the owner, the contractor, the subcontractors and sub subcontractors in the work and shall insure **against risks of direct physical loss – (all perils).** If the owner is damaged by failure of the contractor to purchase or maintain such insurance, then the contractor shall bear all reasonable costs properly attributable thereto; the contractor shall effect and maintain similar property insurance on portions of the work stored off the site when request for payment per articles so includes such portions."

END OF SUPPLEMENTARY CONDITIONS

Statement of Special Inspections

Project: Beaufort County Community College New Skills Building
Location: Washington, NC
Owner's Representative:
Owner's Address: Beaufort County CC, 5337 US HWY 264 East, Washington, NC 27889

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the 2018 North Carolina State Building Code. It includes a Schedule of Special Inspection Services applicable to this project, the name of the Special Inspector, the identity of other approved agencies retained for conducting Special Inspections, and the required inspector qualifications. This Statement of Special Inspections was prepared by the following Designers of Record:

Structural	Peyton D. Mulé, PE		
	(Type or print name)	(Signature)	(Date)
Architectural	John K. Farkas, AIA		
	(Type or print name)	(Signature)	(Date)
Mechanical			
	(Type or print name)	(Signature)	(Date)
Other			
	(Type or print name)	(Signature)	(Date)

The Special Inspector shall keep records of all special inspections and tests and shall furnish reports to the State Construction Office and the Designers of Record. Reports shall indicate if the work inspected or tested was or was not completed in conformance with the approved construction documents. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the State Construction Office and the Designers of Record. The Special Inspections program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the State Construction Office, Owner, and the Designers of Record.

Interim Report Frequency: As Required by Owner

A Final Report of Special Inspections documenting completion of all required Special Inspections, testing, and correction of any discrepancies should be submitted prior to issuance of a Certificate of Use and Occupancy.

Job Site safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Authorization

Signature Date

Accepted for the SCO by:

Signature Date

Schedule of Special Inspection Services[a]

The following sheets comprise the required schedule of special inspections for this project. The construction divisions which require special inspections for this project are as follows.

- ☒ Structural Steel & High Strength Bolting
- ☒ Welding of Structural Steel
- ☒ Cold-Formed Steel Deck
- ☒ Open-Web Steel Joists & Joist Girders
- ☐ Cold-Formed Steel Framing
- ☒ Concrete Construction
- ☒ Masonry Construction [b]
- ☐ Wood Construction
- ☒ Soils
- ☐ Driven Deep Foundations
- ☐ Cast-in-Place Deep Foundations
- ☐ Helical Pile Foundations
- ☐ Rammed Aggregate Piers & Stone Columns
- ☐ Sprayed Fire-Resistant Material
- ☐ Mastic & Intumescent Fire-Resistant Coatings
- ☐ Exterior Insulation & Finish System
- ☐ Fire-Resistant Penetrations & Joints
- ☐ Smoke Control
- ☐ Retaining Wall & Systems > 5 Feet
- ☐ Special Inspections for Wind Resistance
- ☐ Special Inspections for Seismic Resistance

a. The inspection frequency indicated on the following inspection tables are “C” continuous, “P” periodic, & “O” random on a daily basis.
b. Level A is the minimum inspection program for empirically / prescriptively designed masonry in Risk Category I, II or III structures. Level B is the minimum inspection program for empirically / prescriptively designed masonry in Risk Category IV structures and engineered masonry in Risk Category I, II or III structures. Level C is the minimum inspection program for engineered masonry in Risk Category IV structures. Engineered masonry structures are those designed in accordance with portions of the TMS 402-13 / ACI 530-13/ASCE 5-13 other than Part 4 or Appendix A.

Inspection Agents	Firm Name & Point of Contact	Address / Phone / E-mail
1. Special Inspector (SI-1)	**NRW Engineering, P.C. Peyton. D. Mulé, P.E.**	**748 Lord Dunmore Drive Virginia Beach, VA 23464 (757) 474-0612 pdm@nrwengineering.com**
2. Testing Agency (TA-1)		
3. Testing Agency (TA-2)		
4. Geotechnical Engineer (GE-1)		
5. Other (O-1)		

Note: The inspection and testing agent(s) shall be engaged by the Owner or the Registered Design Professional of Record acting as the Owner’s agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the State Construction Office, prior to commencing work.

Seismic Design Category: ☐ A ☒ B ☐ C ☐ D

Basic Wind Speed (V_{asd}): ☒ 90-109mph ☐ 110-119mph ☐ ≥120mph

Wind Exposure Category: ☐ B ☒ C ☐ D

Schedule of Special Inspection Services
Structural Steel and High-Strength Bolting

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			AISC 360	NCBC	
1. Fabricator Certification / Verification of Quality Control Procedures					1
a. Verify fabricator qualifications	☒	C		1704.2.5.1	1
b. Review material test reports & certifications	☒	C	N5.2		1
c. Collect certificates of compliance from the steel fabricator at completion of fabrication	☒	C		1704.5	1
2. Inspections Prior to High-Strength Bolting at Pretensioned and Slip-Critical Joints					
a. Collect manufacturer's certifications for fastener materials	☒	C	Table (Tbl) N5.6-1		1
b. Fasteners are marked per ASTM requirements	☒	P	Tbl N5.6-1		2
c. Ensure correct fasteners and bolting procedures are selected for joint details	☒	P	Tbl N5.6-1		2
d. Verify connecting elements, including the appropriate faying surface condition and hole preparation when specified, comply with the construction documents	☒	P	Tbl N5.6-1		2
e. Observe and document pre-installation verification testing by installation personal for fastener assemblies and methods	☒	P	Tbl N5.6-1		2
f. Verify proper storage provided for all fastener components	☒	P	Tbl N5.6-1		2
3. Inspections During High-Strength Bolting at Pretensioned and Slip-Critical Joints					
a. Ensure correct fastener assemblies placed in all holes and washers, when specified, are positioned as required	☒	P	Tbl N5.6-2		2
b. Verify joint brought to snug-tight condition prior to pretensioning	☒	P	Tbl N5.6-2		2
c. Verify fastener components not turned by the wrench prevented from rotating	☒	P	Tbl N5.6-2		2
d. Ensure fasteners are pretensioned in accordance with RCSC, progressing from the most rigid point towards free edges	☒	P	Tbl N5.6-2		2
4. Document acceptance or rejection of bolted connections after high-strength bolting is complete	☒	C	Tbl N5.6-3		2
5. Structural Details					
a. Verify diameter, grade, type and length of anchor rods and other embedded items supporting structural steel	☒	P	N5.7		1
b. Inspection of fabricated assemblies & erected steel framing verifying compliance with the construction documents	☒	P	N5.7		1/2
6. Composite Construction					
a. Verify placement & installation of steel deck	☐	P	Tbl N6.1		
b. Observe placement and installation of steel headed stud anchors	☐	P	Tbl N6.1		
c. Document acceptance or rejection of composite construction elements	☐	P	Tbl N6.1		

Schedule of Special Inspection Services
Welding of Structural Steel

Inspection Task	Task Req'd	Freq	Code Reference		Agent
			AISC 360	NCBC	
1. Inspections Prior to Welding			N5.4		
a. Collect & review welding procedure specification (WPS) and verify manufacturer certifications for welding consumables	☒	C	Table (Tbl) N5.4-1		1
b. Confirm weld material type & grade	☒	P	Tbl N5.4-1		2
c. Confirm method of welder identification	☒	P	Tbl N5.4-1		2
d. Inspection of fit-up for groove & fillet welds including access hole configuration & finish	☒	P	Tbl N5.4-1		2
2. Inspections During Welding			N5.4		
a. Verify welder qualifications	☒	P	Tbl N5.4-2		2
b. Verify proper control and handling of welding consumables	☒	P	Tbl N5.4-2		2
c. Monitor environmental conditions	☒	P	Tbl N5.4-2		2
d. Monitor proper implementation of WPS	☒	P	Tbl N5.4-2		2
e. Inspection of welding techniques including no welding over cracked tack welds	☒	P	Tbl N5.4-2		2
3. Inspections After Welding			N5.4, N5.5		
a. Verify welds have been cleaned	☒	P	Tbl N5.4-3		2
b. Confirm the installed size, length and location of welds matches the contract documents	☒	C	Tbl N5.4-3		2
c. Verify welds meet visual acceptance criteria	☒	C	Tbl N5.4-3		2
d. Confirm arc strikes comply with Part 5.28 of AWS D1.1	☒	C	Tbl N5.4-3		2
e. Visually observe web k-area for cracks within 3" of welded doubler plates, continuity plates and stiffeners	☐	C	Tbl N5.4-3		
f. Backing and weld tabs removed per contract documents	☐	C	Tbl N5.4-3		
g. Observe and inspect weld repair activities	☒	C	Tbl N5.4-3		2
h. For Risk Category III or IV structures, conduct ultrasonic testing (UT) of CJP groove welds in materials ≥ 5/16" at butt, T- and corner joints subject to transversely applied tension loading	☒	C	N.5.5b, N5.5e		2
i. For Risk Category II structures, conduct ultrasonic testing (UT) of CJP groove welds in materials ≥ 5/16" at butt, T- and corner joints subject to transversely applied tension loading	☐	P	N.5.5b, N5.5f		
j. Conduct magnetic particle testing (MT) or liquid penetrant testing (PT) at thermally cut surfaces of access holes for rolled section with tf > 2" and built-up shape with tw > 2"	☐	C	N5.5c		
k. Radiographic or ultrasonic inspection at joints subject to fatigue	☐	C	N5.5d, Tbl A-3.1		
l. Document acceptance / rejection of welded joints and members	☒	C	Tbl N5.4-3, N5.5g		2

Schedule of Special Inspection Services
Cold-Formed Steel Deck

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			SDI QA/QC	NCBC	
1. Prior to deck placement, verify deck and deck accessories comply with the construction documents	☒	C	Table (Tbl) 1.1		1
2. Inspection Tasks After Deck Placement					
a. Verify the installation of deck & deck accessories complies with the construction documents	☒	C	Tbl 1.2		1/2
b. Verify that deck materials' mill certifications comply with the construction documents	☒	C	Tbl 1.2		1
3. Inspection Tasks Prior to Deck Welding					
a. Collect welding procedure specification (WPS)	☒	P	Tbl 1.3		1
b. Collect manufacturer certifications for welding consumables	☒	P	Tbl 1.3		1
c. Verify material type and grade	☒	P	Tbl 1.3		2
d. Check welding equipment	☒	P	Tbl 1.3		2
4. Inspection Tasks During Deck Welding					
a. Verify welder qualifications	☒	P	Tbl 1.4		2
b. Verify proper control and handling of welding consumables	☒	P	Tbl 1.4		2
c. Monitor environmental conditions	☒	P	Tbl 1.4		2
d. Monitor proper implementation of WPS	☒	P	Tbl 1.4		2
5. Inspection Tasks After Welding					
a. Verify size and location of welds, including support, sidelap and perimeter welds	☒	C	Tbl 1.5		2
b. Verify welds meet visual acceptance criteria	☒	C	Tbl 1.5		2
c. Observe weld repair activities	☒	C	Tbl 1.5		2
6. Inspection Tasks Prior to Mechanical Fastening					
a. Verify manufacturer installation instructions available for mechanical fasteners	☒	P	Tbl 1.6		2
b. Proper tools available for fastener installation	☒	P	Tbl 1.6		2
c. Verify proper storage of mechanical fasteners	☒	P	Tbl 1.6		2
7. Inspection Tasks During Mechanical Fastening					
a. Observe fastener spacing and position	☒	P	Tbl 1.7		2
b. Verify fasteners are installed in accordance with manufacturer's instructions	☒	P	Tbl 1.7		2
8. Inspection Tasks After Mechanical Fastening					
a. Check spacing, type and installation of support fasteners	☒	C	Tbl 1.8		2
b. Check spacing, type, and installation of sidelap fasteners	☒	C	Tbl 1.8		2
c. Check spacing, type, and installation of perimeter fasteners	☒	C	Tbl 1.8		2
d. Verify repair activities	☒	C	Tbl 1.8		2
9. Document acceptance or rejection of deck & deck accessories for all phases of construction	☒	C	Tbls 1.1 thru 1.8		2

Schedule of Special Inspection Services
Open-Web Steel Joists and Joist Girders

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Fabricator Certification / Verification of Quality Control Procedures					
a. Verify fabricator qualifications	☒	C		1704.2.5.1	1
b. Collect certificate of compliance from steel joist producer at completion of manufacture	☒	C		1704.5, 2207.5	1
2. Observe bolted and welded joist end connections	☒	P	SJI-K 5.3, 5.6, SJI-LH/DLH 104.4, 104.7, SJI-JG 1004.4, 1004.6, SJI-CJ 104.4, 104.7	Table (Tbl) 1705.2.3	2
3. Verify size, spacing and connection of standard horizontal and diagonal bridging	☒	P	SJI-K 5.4, SJI-LH/DLH 104.5, SJI-JG 1004.5, 1004.9, SJI-CJ 104.5	Tbl 1705.2.3	1/2
4. Verify size, spacing and connection of bridging that differs from the SJI specifications listed by Part 2207.1 of the NCBC	☐	P		Tbl 1705.2.3	

Schedule of Special Inspection Services
Cold-Formed Steel Framing

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Fabricator Certification / Verification of Quality Control Procedures					
a. Verify fabricator qualifications	☐	C		1704.2.5.1	
b. Collect certificates of compliance from the steel fabricator at completion of fabrication	☐	C		1704.5	
2. For trusses clear spanning 60 feet or more, verify that both temporary and permanent restraints and braces are installed in accordance with the approved truss submittal package.	☐	P		1705.2.4	

Schedule of Special Inspection Services
Concrete Construction

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard[a]	NCBC	
1. Inspect reinforcement, including prestressing tendons, and verify placement	☒	P	ACI Ch.20, 25.2, 25.3, 26.6.1-26.6.3	1908.4	1
2. Reinforcing Bar Welding:			AWS D1.4		
e. Verify weldability of reinforcing bars other than ASTM A706 and collect reports	☐	P	ACI 26.6.4	1704.5	
f. Inspect single-pass fillet welds ≤ 5/16"	☒	P	ACI 26.6.4		2
g. Inspect all welds other than single-pass fillet welds ≤ 5/16"	☐	C	ACI 26.6.4		
3. Concrete Anchors:					
a. Inspect anchors cast in concrete	☒	P	ACI 17.8.2		1
b. Inspect adhesive anchors installed in hardened concrete with horizontally or upwardly inclined orientations that resist sustained tension loads	☐	C	ACI 17.8.2.4		
c. Inspect adhesive anchors installed in hardened concrete with orientations different from Item 3.b	☒	P	ACI 17.8.2		2
d. Inspect mechanical anchors installed in hardened concrete	☒	P	ACI 17.8.2		2
4. Collect mix designs and verify the correct mix used during installation	☒	P	ACI Ch19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3	1
5. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	☒	C	ASTM C172, ASTM C31, ACI 26.4, 26.12	1908.10	2
6. Inspect concrete and shotcrete placement for proper application techniques	☒	C	ACI 26.5	1908.6, 1908.7, 1908.8	2
7. Collect reports of preconstruction tests for shotcrete when preconstruction tests are required by NCBC Section 1908.4	☐	C		1704.5, 1908.5	
8. Verify maintenance of specified curing temperature and techniques	☒	P	ACI 26.5.3-26.5.5	1908.9	1/2
9. Inspections for prestressed concrete					
a. Observe application of prestressing force	☐	C	ACI 26.10		
b. Inspect grouting of bonded prestressing tendons	☐	C	ACI 26.10		
10. Verify concrete strength prior to stressing of PT tendons and prior to removal of shores and forms from PT & mild beams and structural slabs	☐	P	ACI 26.11.2		
11. Inspect erection of precast members	☐	P	ACI 26.8		
12. Inspect formwork for shape, location and dimensions of the concrete member being formed	☐	P	ACI 26.11.1.2(b)		
13. Collect mill test reports for ASTM A615 rebar used by SFRS special moment frames, special structural walls or coupling beams	☐	C	ACI 20.2.2.5	1704.5	

a. References to "ACI" in this table are to the ACI 318-14.

Schedule of Special Inspection Services
Masonry – Level A

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			TMS 402[a]	TMS 602[a]	
1. Prior to construction, verify certificates of compliance used in masonry construction	☐	P	Table 3.1.1	Art. 1.5	

a. References to "TMS402" in this table are to the TMS402/ACI530/ASCE5-13. References to "TMS602" are to TMS602/ACI530.1/ASCE6-13.

Schedule of Special Inspection Services
Masonry – Level B

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			TMS 402[a]	TMS 602[a]	
1. Test & verify slump flow & visual stability index as delivered to site for self-consolidating grout	☐	C	Table (Tbl) 3.1.2	Art. 1.5B.1.b.3	
2. Test & verify f'm & f'_{AAC} prior to construction	☐	C	Tbl 3.1.2	Art. 1.4B	
3. Verify compliance with the approved submittals	☒	P	Tbl 3.1.2	Art. 1.5	1
4. As masonry construction begins, verify that the following are in compliance:					
a. Proportions of site-prepared mortar	☒	P		Art. 2.1, 2.6A	2
b. Construction of mortar joints	☒	P		Art. 3.3B	2
c. Grade and size of prestressing tendons and anchorages	☐	P		Art. 2.4B, 2.4H	
d. Location of reinforcement, connectors and prestressing tendons and anchorages	☒	P		Art. 3.4, 3.6A	1/2
e. Prestressing technique	☐	P		Art. 3.6B	
f. Properties of thin-bed mortar at AAC masonry	☐	C / P_b		Art. 2.1C	
5. Prior to grouting, verify that the following comply:					
a. Grout space is clean, and cleanouts provided when required	☒	P		Art. 3.2D, 3.2F	2
b. Grade, type & size of reinforcement & anchor bolts, & prestressing tendons & anchorage	☒	P	Sec. 6.1	Art. 2.4, 3.4	1/2
c. Placement of reinforcement, connectors, and prestressing tendons and anchorage	☒	P	Sec. 6.1, 6.2.1, 6.2.6, 6.2.7	Art.3.2E, 3.4, 3.6A	1/2
d. Proportions of site-prepared grout and prestressing grout for bonded tendons	☒	P		Art. 2.6B, 2.4G.1.b	2
e. Construction and size of mortar joints	☒	P		Art. 3.3B	2
6. Verify during construction:					
a. Size and location of structural elements	☒	P		Art. 3.3F	2
b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	☒	P	Sec. 1.2.1(e), 6.1.4.3, 6.2.1		2
c. Welding of reinforcement	☐	C	Sec. 8.1.6.7.2, 9.3.3.4(c), 11.3.3.4(b)		
d. Preparation, construction, and protection of masonry during cold weather (temperature < 40ºF) or hot weather (temperature > 90ºF)	☒	P		Art. 1.8C, 1.8D	1/2
e. Application & measurement of prestress force	☐	C		Art. 3.6B	
f. Verify placement of grout and prestressing grout for bonded tendons	☒	C		Art. 3.5, 3.6C	2
g. Placement of AAC masonry units and construction of thin-bed mortar joints	☐	C / P_b		Art. 3.3B.9, 3.3F.1.b	
7. Observe preparation of grout specimens, mortar specimens, and or prisms	☒	P		Art. 1.4.B.2.a.3, 1.4.B.2.b.3, 1.4.B.2.c.3, 1.4.B.3, 1.4.B.4	2

a. References to "TMS402" in this table are to the TMS402/ACI530/ASCE5-13. References to "TMS602" are to TMS602/ACI530.1/ASCE6-13.
b. AAC masonry shall be continuously inspected for the first 5000-square feet and periodically inspected afterwards.

Schedule of Special Inspection Services
Masonry – Level C

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			TMS 402[a]	TMS 602[a]	
1. Test & verify f'm & f'$_{AAC}$ prior to construction & for every 5,000 square feet during construction	☐	C	Table (Tbl) 3.1.3	Art. 1.5	
2. Test & verify proportions of materials in premixed / preblended mortar, prestressing grout, and grout other than self-consolidating, as delivered to site	☐	C	Tbl 3.1.3		
3. Test & verify slump flow & visual stability index as delivered to site for self-consolidating grout	☐	C	Tbl 3.1.3	Art. 1.5B.1.b.3	
4. Verify compliance with the approved submittals	☐	P	Tbl 3.1.3	Art. 1.5	
5. Verify that the following are in compliance:					
a. Proportions of site-mixed mortar, grout and prestressing grout for bonded tendons	☐	P		Art. 2.1, 2.6A, 2.6B, 2.6C, 2.4G.1.b	
b. Grade, type, & size of reinforcement & anchor bolts, & prestressing tendons & anchorage	☐	P	Sec 6.1	Art. 2.4, 3.4	
c. Placement of masonry units and construction of mortar joints	☐	P		Art. 3.3B	
d. Placement of reinforcement, connectors, and prestressing tendons and anchorages	☐	C	Sec 6.1, 6.2.1, 6.2.6, 6.2.7	Art. 3.2E, 3.4, 3.6A	
e. Grout space is clean, and cleanouts provided when required	☐	C		Art. 3.2D, 3.2F	
f. Placement of grout and prestressing grout for bonded tendons	☐	C		Art. 3.5, 3.6C	
g. Size and location of structural elements	☐	P		Art. 3.3F	
h. Type, size, and location of anchors including other details of anchorage of masonry to structural members, frames, or other construction	☐	C	Sec. 1.2.1(e), 6.1.4.3, 6.2.1		
i. Welding of reinforcement	☐	C	Sec 8.1.6.7.2, 9.3.3.4(c), 11.3.3.4(b)		
j. Preparation, construction, and protection of masonry during cold weather (temperature < 40ºF) or hot weather (temperature > 90ºF)	☐	P		Art. 1.8C, 1.8D	
k. Application and measurement of prestressing force	☐	C		Art. 3.6B	
l. Placement of AAC masonry units and construction of thin-bed mortar joints	☐	C		Art. 3.3B.9, 3.3F.1.b	
m. Properties of thin-bed mortar for AAC masonry	☐	C		Art. 2.1C.1	
6. Observe preparation of grout specimens, mortar specimens, and or prisms	☐	C		Art. 1.4B.2.a.3, 1.4B.2.b.3, 1.4B.2.c.3, 1.4B.3, 1.4B.4	

a. References to "TMS402" in this table are to the TMS402/ACI530/ASCE5-13. References to "TMS602" are to TMS602/ACI530.1/ASCE6-13.

Schedule of Special Inspection Services
Wood Construction

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Fabricator certification / verification of quality control procedures for prefabricated wood structural elements and assemblies					
a. Verify fabricator qualifications	☐	C		1704.2.5.1, 1705.5	
b. Collect certificates of compliance from the fabricator at completion of fabrication	☐	C		1704.5, 1705.5	
2. High-load diaphragms				2306.2	
a. Verify that wood structural panel sheathing is the correct grade and thickness	☐	P		1705.5.1	
b. Verify nominal size of framing members and blocking at adjoining panel edges	☐	P	AWC-SDPWS 4.2.7.1.2	1705.5.1	
c. Nail and or staple diameter, length, quantity and spacing comply with the contract documents	☐	P		1705.5.1	
3. For metal-plate-connected trusses clear spanning 60 feet or more, verify that both temporary and permanent restraints and braces are installed in accordance with the approved truss submittal package	☐	P		1705.5.2	

Schedule of Special Inspection Services
Soils

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agents
			Standard	NCBC	
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity	☒	P		1705.6	2
2. Verify excavations extend to proper depth and have reached the correct soil material	☒	P		1705.6	2
3. Perform classification and testing of compacted fill materials	☒	P		1705.6	2
4. Verify that materials used, densities, lift thickness and procedures used during placement and compaction of compacted fill are in accordance with the approved soils report and the construction documents	☒	C		1705.6	2
5. Prior to placement of compacted fill, verify that the subgrade has been prepared in accordance with the approved soils report and the construction documents	☒	P		1705.6	2

Schedule of Special Inspection Services
Driven Deep Foundations [a b c]

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agents
			Standard	NCBC	
1. Verify that deep foundation materials, sizes and lengths comply with the construction documents	☐	C		1705.7	
2. Observe pile load tests and determine capacities of test elements ensuring compliance with the construction documents.	☐	C		1705.7	
3. Inspect driving operations and maintain complete and accurate records for each element	☐	C		1705.7	
4. Verify placement, location, plumbness, hammer size and type, blow count per foot of penetration, required penetrations to achieve design capacity, tip and butt elevations, damage and anomalies	☐	C		1705.7	

a. For steel elements, perform additional inspections in accordance with Section 1705.2 of the North Carolina Building Code and the applicable Schedules included herein

b. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3 of the North Carolina Building Code and the applicable Schedules included herein

c. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge and the applicable Schedules included herein

Schedule of Special Inspection Services
Cast-in-Place Deep Foundations [a]

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agents
			Standard	NCBC	
1. Observe drilling operations and maintain complete and accurate records	☐	C		1705.8	
2. Verify deep foundation materials comply with the construction documents	☐	C		1705.8	
3. Verify pile placement, location, plumbness, diameters, bell diameter (if applicable), lengths, rock embedment, end-bearing strata capacity, and anomalies	☐	C		1705.8	
4. Record concrete or grout volumes	☐	C		1705.8	

a. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3 of the North Carolina Building Code and the applicable Schedules included herein

Schedule of Special Inspection Services
Helical Pile Foundations

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agents
			Standard	NCBC	
1. Confirm the following are in compliance with the construction documents prepared by the registered design professional in responsible charge: The installation equipment used, pile dimension, pile placement location, tip elevations, final depth, and final installation torque	☐	C		1705.9	

Schedule of Special Inspection Services
Rammed Aggregate Piers & Stone Columns

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Verify that the pier installation program and soil parameters are in accordance with the approved soils report and the construction documents	☐	C		1705.1.1	
2. During installation, verify the aggregate properties, type and number of lifts of aggregate, pier size, installed depth, top elevation and applied ram energy	☐	P		1705.1.1	
3. Review the modulus load testing, uplift pull-out testing, bottom or crowd stabilization tests and dynamic cone penetration test results from production pier elements and verify that all comply with the design specifications	☐	C		1705.1.1	

Schedule of Special Inspection Services
Sprayed Fire-Resistant Materials [a]

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
4. Prior to the application of sprayed on fire resistant materials, verify structural member surfaces are prepared in accordance with the approved fire-resistance design and the written instructions of the approved manufacturer	☐	P		1705.14.2	
5. During the application of sprayed on fire resistant materials, verify that the following are in compliance:					
a. Substrate has minimum ambient temperature before and after application as specified by the fire resistance design and approved manufacturer's written instructions	☐	P		1705.14.3	
b. Work area properly ventilated during and after application				1705.14.3	
c. Thickness of sprayed on material conforms with the approved fire resistance design and NCBC minimums	☐	P		1705.14.4, 1705.14.4.4, 1705.14.4.5, 1705.14.4.6, 1705.14.4.7, 1705.14.4.8, 1705.14.4.9	
d. The density of sprayed on materials is not less than the requirements of the approved fire-resistance design	☐	P		1705.14.5	
e. The cohesive / adhesive bond strength is not less than 150 pounds per square foot	☐	P		1705.14.6	

a. Inspections shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems, and suspension systems for ceilings.

Schedule of Special Inspection Services
Mastic and Intumescent Fire-Resistant Coatings

Inspection Task	Task Req'd	Freq(a)	Reference for Criteria		Agents
			Standard	NCBC	
1. Prior to application, verify preparation of substrate and suitability of primers, if present, are in accordance with approved fire resistance design, approved manufacturer's written instructions, and the requirements of AWCI 12-B	☐	P	AWCI 12-B	1705.15	
2. Observe the application of fire-resistant coatings ensuring compliance with approved fire resistance design, approved manufacturer's written instructions, and the requirements of AWCI 12-B	☐	P	AWCI 12-B	1705.15	
3. After adequate drying but prior to the application of any topcoat, measure the final mastic / intumescent material thickness ensuring compliance with the construction documents and approved material / installation submittals. Measurements must consider the thickness of primers or other existing coatings on the surface of the substrate.	☐	P	AWCI 12-B	1705.15	

Schedule of Special Inspection Services
Exterior Insulation and Finish Systems (EIFS)

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Verify that EIFS is installed in conformance with project specifications	☐	P		1705.16	
2. If a water resistive barrier coating complying with ASTM E2570 is installed over a sheathing substrate, verify that the water-barrier and drainage strip are installed in conformance with the project specifications.	☐	P		1705.16.1	

Schedule of Special Inspection Services
Fire-resistant Penetrations and Joints [a]

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Inspect through-penetration firestop systems at fire walls, fire barriers, smoke barriers and fire partition walls in accordance with ASTM E2174	☐	P		1705.17.1, 714.3.1.2	
2. Inspect penetration firestop systems at penetrations through membranes that are part of a horizontal assembly in accordance with ASTM E2174	☐	P		1705.17.1, 714.4.2	
3. Inspect fire-resistant joint systems in accordance with ASTM 2393	☐	P		1705.17.2, 715.3, 715.4	

a. The inspection of fire-resistant penetrations and joints applies only to high-rise buildings or buildings assigned to Risk Category III or IV.

Schedule of Special Inspection Services
Retaining Walls Exceeding 5 Feet [a b c d]

Inspection Task	Task Req'd	Freq[(a)]	Reference for Criteria		Agent
			Standard	NCBC	
1. Foundation support system is adequate for the intended site conditions	☐	P		1807.2.5.1	
2. Verify that retaining wall materials and installations are in compliance with the construction documents	☐	P		1807.2.5.2	
3. Verify that actual soil conditions are similar to those anticipated by the approved engineered design	☐	P		1807.2.5.3	
4. Examination of backfill materials for compliance with the approved specifications	☐	P		1807.2.5.4	
5. Confirm that all subsoil drainage piping is undamaged, drains freely to the designated outlet or structure, and has been installed per the approved engineered design	☐	P		1807.2.5.4	

a. All retaining walls exceeding 5 feet in height require special inspections.

b. For concrete retaining walls and footings, perform additional inspections in accordance with Section 1705.3 of the North Carolina Building Code and the applicable Schedules included herein

c. For masonry retaining walls, perform additional inspections in accordance with Section 1705.4 of the North Carolina Building Code and the applicable Schedules included herein

d. For soils, perform additional inspections in accordance with Section 1705.6 of the North Carolina Building Code and the applicable Schedules included herein

Schedule of Special Inspection Services
Smoke Control

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. During erection of ductwork and prior to concealment, perform leakage testing and record device location(s)	☐	P		1705.18.1.1	
2. Upon completion of smoke control system, perform pressure difference testing, flow measurements, and detection and control verification	☐	P		1705.18.1.2	

Schedule of Special Inspection Services
Special Inspections for Wind Resistance

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Prior to any work taking place, each contractor responsible for the construction of a wind-resisting system or component shall submit a written statement of contractor responsibility	☐	C		1704.4	
2. Structural Wood					
a. Verify field gluing operations pertinent to the main wind force-resisting system	☐	C		1705.11.1	
b. Inspect nailing, anchoring, and fastening of components within the main windforce-resisting system including shear walls, diaphragms, drag struts, braces & hold-downs	☐	P		1705.11.1	
3. Cold-Formed Steel Light Frame Construction					
a. Inspect welding operations at elements of the main windforce-resisting system	☐	P		1705.11.2	
b. Inspect screw attachment, bolting, anchoring, and fastening of elements within the main windforce-resisting system including shear walls, braces, diaphragms collectors, drag struts and hold-downs	☐	P		1705.11.2	
4. Wind-resisting components					
a. Inspect the fastening of roof covering, roof deck and supporting roof framing connections	☐	P		1705.11.3.1	
b. Inspect the fastening of exterior wall coverings & the wall connections to the roof / floor diaphragms & framing members	☐	P		1705.11.3.2	

Structural Wood and Cold-Formed Steel Light-Frame Construction Main Wind-Force Resisting System(s) Subject to Special Inspections:

Roof Cladding Components and Connections Subject to Special Inspections:

Wall Cladding Components and Connections Subject to Special Inspections:

Schedule of Special Inspection Services
Special Inspections for Seismic Resistance

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Prior to any work taking place, each contractor responsible for the construction of a seismic-resisting system or component shall submit a written statement of contractor responsibility	☐	C		1704.4	
2. Structural Steel (see following tables)	☐	O/C		1705.12.1	
3. Structural Wood					
a. Verify field gluing operations of elements of the seismic force-resisting system (SFRS)	☐	C		1705.12.2.1	
b. Inspect nailing, bolting, anchoring & other fastening at elements of SFRS	☐	P		1705.12.2.2	
4. Cold-Formed Steel Light Frame Construction					
a. Verify welding operations of elements of the SFRS	☐	P		1705.12.3.1	
b. Inspect screw attachment, bolting, anchoring, & fastening used by SFRS	☐	P		1705.12.3.2	
c. Inspect special bolted moment frames	☐	P		1705.12.9	
5. Verify erection & fastening of exterior cladding, non-bearing walls and veneer	☐	P		1705.12.5	
6. Confirm anchorage of access floors	☐	P		1705.12.5.1	
7. Confirm anchorage of storage racks	☐	P		1705.12.7	
8. Collect certificates of compliance for qualifying equipment, supports, attachments & components; verify correctness of labels & installation	☐	C	ASCE7 13.2.2, 13.2.1	1705.12.4, 1705.13.2	
9. Plumbing, Mechanical, Electrical Components					
a. Verify anchorage of elec. equip for emergency & standby power systems	☐	P		1705.12.6	
b. Verify installation & anchorage of pipe & duct systems carrying hazardous materials & associated mech units	☐	P		1705.12.6	
c. Confirm the installation & anchorage of vibration isolation systems with nominal clearances ≤¼"	☐	P		1705.12.6	
d. Inspect & test seismic isolation systems at seismic isolated structures	☐	P	ASCE7 17.8	1705.12.8, 1705.13.4	

Seismic-Force Resisting System(s) subject to Special Inspections: _____

Seismic-Resisting Components and Connections Subject to Special Inspections:

Schedule of Special Inspection Services
Special Inspections for Seismic Resistance
Structural Steel & High-Strength Bolting

Inspection Task	Task Req'd	Freq[a]	Reference for Criteria		Agent
			AISC 341	NCBC	
1. Inspections Prior to Bolting					
a. Proper fasteners selected for the joint detail	☐	O	Table J7-1		
b. Correct bolting procedure selected for joints	☐	O	Table J7-1		
c. Faying surface condition, hole preparation, etc. meet applicable requirements for connecting elements		O	Table J7-1		
d. Pre-installation verification testing by installation personnel observed for fastener assemblies and methods used	☐	O	Table J7-1		
e. Fastener components are stored properly	☐	O	Table J7-1		
2. Inspection Tasks During Bolting					
a. Fastener assemblies placed in all holes and washers are positioned as required	☐	O	Table J7-2		
b. Joint brought to "snug tight" prior to pretensioning operation	☐	O	Table J7-2		
c. Fastener component not turned by the wrench prevented from rotating	☐	O	Table J7-2		
d. Bolt pretensioning progresses systematically from the most rigid point toward the free edge	☐	O	Table J7-2		
3. After bolting activities are complete, document accepted and rejected connections	☐	C	Table J7-3		
4. Verify contour, finish and dimensional tolerances of reduced beam sections (RBS)	☐	C	Table J8-1		
5. Ensure no holes or unapproved attachments made by fabricator or erector in protected zone	☐	C	Table J8-1		
6. Inspection of Composite Structures Prior to Concrete Placement					
a. Verify reinforcing steel type and grade	☐	O	Table J9-1		
b. Determine carbon equivalent for reinforcing steel other than ASTM A706	☐	O	Table J9-1		
c. Verify reinforcing size, spacing & orientation	☐	O	Table J9-1		
d. Verify reinforcing steel not re-bent in field	☐	O	Table J9-1		
e. Reinforcing tied & supported as required	☐	O	Table J9-1		
d. Required reinforcing clearances are provided	☐	O	Table J9-1		
e. Composite member has required size	☐	O	Table J9-1		
7. Inspection of Composite Structures During Concrete Placement					
a. Verify mix design, compressive strength, maximum aggregate size, maximum slump	☐	O	Table J9-2		
b. Limits on water added at the truck or pump	☐	O	Table J9-2		
c. Proper placement to limit segregation	☐	O	Table J9-2		
8. After concrete placement of composite structures, verify specified f'c achieved at specified age	☐	C	Table J9-3		

Schedule of Special Inspection Services
Special Inspections for Seismic Resistance
Welding of Structural Steel

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			AISC 341	NCBC	
1. Visual Inspections Prior to Welding					
a. Verify type & grade of connection materials	☐	O	Table J6-1		
b. Welder identification system established	☐	O	Table J6-1		
c. Fit-up & joint geometry of groove welds • Joint preparation • Dimensions including alignment, root opening, root face & bevel • Cleanliness of steel surfaces • Tack weld quality & location • Backing type & fit		O	Table J6-1		
d. Verify configuration & finish of access holes	☐	O	Table J6-1		
e. Inspect fit-up of fillet welds including dimensions, alignment, root gaps, cleanliness of steel surfaces, tack weld quality, and tack weld location	☐	O	Table J6-1		
2. Visual Inspection Tasks During Welding					
a. Verify welding procedure specification (WPS) followed: Settings on welding equipment, travel speed, welding materials selected, shielding gas type & flow rate, preheat applied, interpass temperature maintained, weld position (F, V, H, OH), and intermix of filler metals avoided unless approved by engineer of record	☐	O	Table J6-2		
b. Verify welder qualifications	☐	O	Table J6-2		
c. Control & handling of welding consumables, including packaging & exposure	☐	O	Table J6-2		
d. Environmental conditions, including wind speed, precipitation & temperature, within defined limits	☐	O	Table J6-2		
e. Verify welding techniques: Interpass & final cleaning, each pass within profile limitations, and each pass meets quality requirements	☐	O	Table J6-2		
f. No welding over cracked tack welds	☐	O	Table J6-2		
3. Visual Inspections Tasks After Welding					
g. Verify welds are cleaned	☐	O	Table J6-3		
h. Confirm correct weld size, length & location	☐	C	Table J6-3		
i. Welds meet visual acceptance criteria: Crack prohibition, weld/base-metal fusion, crater cross section, weld profiles and size, undercut & porosity	☐	C	Table J6-3		
j. Confirm placement of reinforcing or contouring fillet welds	☐	C	Table J6-3		
k. Verify backing removed, weld tabs removed & finished, and fillet welds added	☐	C	Table J6-3		
l. Observe repair activities	☐	C	Table J6-3		

Schedule of Special Inspection Services
Special Inspections for Seismic Resistance
Non-Destructive Testing (NDT) of Welded Joints

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			AISC 341	Standard	
1. Web base metal tested for cracks using magnetic particle testing (MT) when doubler plates, continuity plates or stiffeners are welded in the k-area. MT inspection shall include k-area metal within 3" of the weld and be performed ≥ 48hours	☐	C	Part J6.2a		
2. Inspect complete Joint Penetration (CJP) Groove Welds in materials ≥ 5/16" thick					
a. Ultrasonic testing (UT) performed on 100% of CJP groove welds except for ordinary moment frames for which only *demand critical welds* need be tested	☐	C	Part J6.2b, J6.2g	AWS D1.1 Table 6.2	
b. MT performed on 25% of beam-to-column CJP groove welds except for ordinary moment frames for which only *demand critical welds* need be tested	☐	P	Part J6.2b, J.6.2h		
c. At the end of welds where weld tabs have been removed (excluding continuity plate weld tabs), MT performed on 100% of beam-to-column joints receiving UT in accordance with Item 2.a above	☐	C	Part J6.2f, J.6.2h		
3. UT check for base metal lamellar tearing & laminations at base metal thickness ≥ 1½" loaded in tension in through-thickness direction in tee & corner joints where connected material is ≥ ¾" and contains CJP groove welds	☐	C	Part J6.2c	AWS D1.1 Table 6.2	
4. At welded splices & connections, MT or penetrant testing performed at thermally cut surfaces of beam copes and access holes when flange thickness > 1½" (rolled shapes) or web thickness > 1½" (built-up shape)	☐	C	Part J6.2d		
5. MT performed on welds & adjacent areas of reduced beam section (RBS) cut surface repaired by welding or on base metal of RBS cut surfaces if a sharp notch was removed by grinding	☐	C	Part J6.2e		

Schedule of Special Inspection Services
Special Inspections for Seismic Resistance
Steel H-Piles

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			AISC 341	NCBC	
1. Ensure no holes or unapproved attachments made by responsible contractor in protected zone	☐	C	Table J10-1		

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Access to site.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and drawing conventions.
10. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: Beaufort Community College New Skills Building.

1. Project Location: Washington, NC.

B. Owner: Beaufort Community College.

1. Owner's Representative: Laura Kelly, Director of Campus Operations.

C. Architect: JKF ARCHITECTURE PC, Greenville, NC.

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

1. Civil Engineering: Rivers & Associates, Inc.

2. Structural Engineering: Neser & Roomsburg, P.E.

3. PME Engineering: Atlantec Engineers

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Construction of a 6,258 GSF, 1-story Building, of Type IIB Construction.

2. New exterior walls are constructed of 4” face brick, 2.75” air gap, bituminous damp-proofing, 2” rigid insulation, and 8” or 12” CMU. New addition will have a steel-framed structure with steel trusses and metal deck. A 4” concrete slab on grade with perimeter insulation will be provided. New roof assembly is constructed of a standing seam metal roof, self-adhering sheet, 6” extruded polystyrene, and 1/2” glass-mat sheathing. New exterior thermally-broken aluminum windows, corrugated metal panels, and fixed louvers will be utilized. All new exterior doors shall be aluminum stile and rail or aluminum FRP door assemblies in aluminum frames. Continuous gear hinges will be provided.

3. New interior doors will be hollow metal doors in hollow metal frames. Door hardware will be mortise type lockets with lever handles and use mortise cylinder system. Painted, exposed ceilings will be throughout, with the exception of acoustical panel ceilings in rooms indicated on plans. Interior flooring will be vinyl flooring throughout. Ceramic tile on the floors and a wall of restrooms. Exposed concrete sealed in the Open Shop and Mechanical Room. All walls will be painted CMU or gypsum board except indicated wall in restrooms that will have one wall ceramic tile in each.

4. New Plumbing, HVAC, Electrical, and Fire Alarm

5. Sitework including new road and parking pavement and sidewalks and site grading as required. Utilities will include new water, sewer ,and electrical to new building.

B. Type of Contract:

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

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in a single phase.

1.6 ACCESS TO SITE

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

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet beyond building perimeter; 10 feet beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
3. Access to the site shall be through the Southwest corner of lot through new entry way shown on site plan. Laydown areas shall be the open grass area to the east of the building.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

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

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

1. Notify Architect and Owner not less than two days in advance of proposed utility interruptions.

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

1. Notify Architect and Owner not less than two days in advance of proposed disruptive operations.

D. Nonsmoking Building: Smoking is not permitted within the building or on-site.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.

1.3 ALLOWANCES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. **Allowance No. 1**: **Remove Unsuitable Soils**:

1. Description: Remove and disposal off-site and replace of unsuitable soils in building pad or parking areas, excluding that required for footings, foundations, and utility trenches, as directed by the architect. Suitable fill material includes compacted sand fill as specified in Section 312000 "Earth Moving." Material, labor to remove, dispose, and install, fill materials, supervision, overhead and profit, delivery charges, etc., are to be included in the Base Bid. Final quantities necessary for the project will be based on actual quantities determined by the Owner's testing agency and confirm by Designers. Adjustments made based on the final quantities shall be per Unit Price #1.
2. Base Bid Quantity to be included in Base Bid: 200 CY.
3. On Bid Form indicated Lump Sum amount for Base Bid Quantity.
4. No changes in the Contract duration for the first 200 CY that require removal and replacement. If quantities exceed 200 CY, adjustments to duration will be made by Unit Price #1.

B. **Allowance No. 2: Remove Unsuitable Soils (#57 Stone)**:

1. Description: Remove and dispose off-site and replace unsuitable soils in footings, foundations, and utility trenches, as directed by the architect. Suitable fill material includes #57. Labor to remove, dispose, and install, fill materials, supervision, overhead and profit, delivery charges, etc., are to be included in the Base Bid. Final quantities necessary for the project will be based on actual quantities determined by the Owner's testing agency and confirm by Designers. Adjustments made based on the final quantities shall be per Unit Price #2.
2. Base Bid Quantity to be included in Base Bid: 200 CY.
3. On Bid Form indicated Lump Sum amount for Base Bid Quantity.
4. No changes in the Contract duration for the first 200 CY that require removal and replacement. If quantities exceed 200 CY, adjustments to duration will be made by Unit Price #2.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. **Unit Price No. 1 -** Remove and replace unsuitable soils in building pad or parking areas.

1. Description: Remove and replace unsuitable soils in building pad or parking areas, excluding that required for footings, foundations, and utility trenches, as directed by the architect. Suitable fill

material includes compacted sand fill above that required by the Contract Documents including Allowances, as directed by the Architect.

2. Unit of Measurement: Per cubic yard in place.
3. Add 1 calendar day to the Contract duration for every part of 200 CY of unsuitable soils removed. No extended overhead recovery will be permitted as part of this Unit Price.

B. **Unit Price No. 2 -** Remove and replacement unsuitable soils in footings, foundations, and utility trenches.

1. Description: Remove and replacement unsuitable soils in footings, foundations, and utility trenches, as directed by the architect. Suitable fill material may include compacted sand fill or #57 stone directed by the Architect, but use of either shall not alter the unit price.
2. Unit of Measurement: Per cubic yard in place.
3. Add 1 calendar day to the Contract duration for every part of 200 CY of unsuitable soils removed. No extended overhead recovery will be permitted as part of this Unit Price.

C. **Unit Price No. 3 -** Provide geotechnical fabric, geogrid, or other suitable stabilization material.

1. Description: Upon approval of the Architect, utilized geotechnical fabric to stabilized areas of unsuitable soils including building pad and parking area preparation. Building pad includes entire building area including excavations for footings, foundations, and utility trenches.
2. Unit of Measurement: Per square yard in place.
3. Add 1 calendar day to the Contract duration for every part of 500 SY of fabric installed. No extended overhead recovery will be permitted as part of this Unit Price.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

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

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

1.4 PROCEDURES

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

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

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. **Alternate Bid No. 1**– Preferred Alternate; Fire Alarm System by Firelite
   1. Description: Add to Base Bid the cost for providing Firelite as the preferred brand alternate per the Contract Documents.
   2. Time Impact: If accepted, 0 days added to Base Bid.

B. **Alternate Bid No. 2**– Preferred Alternate; Corbin-Russwin.
   1. Description: Add to Base Bid the cost for providing Corbin-Russwin Door Hardware where indicated as Basis of Design.
   2. Time Impact: If accepted, 0 days added to Base Bid.
   3. Alternate includes installation of units, final electrical and all final utility connections.
   4. Time Impact: If accepted, 0 days added to Base Bid.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

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

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

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use Contractor's Standard Form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 60 days after Notice to Proceed.

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

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution provides sustainable design characteristics that specified product provided.

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

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

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

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

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect.

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

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

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

1.5 ADMINISTRATIVE CHANGE ORDERS

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

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

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor via The NC State Construction Interscope System.

1.7 CONSTRUCTION CHANGE DIRECTIVE OR FIELD ORDER

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

    a. Application for Payment forms with Continuation Sheets.
    b. Submittals Schedule.
    c. Contractor's Construction Schedule.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than 21 days after notice to proceed. Provide separate schedule for each Armory.

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

1. Submit draft of **AIA Document G703 Continuation Sheets**.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; 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.

1.5 APPLICATIONS FOR PAYMENT

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

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. 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 AIA Document G703 Continuation Sheets** as form for Applications for Payment.

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

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

E. Transmittal: Submit 4 signed and notarized original copies of each Application for Payment to **Architect** by a method ensuring receipt **within 24 hours**. One copy shall include waivers of lien and similar attachments if required.

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

F. Initial Payment: Initial Application for Payment will not be reviewed or executed until the following administrative submittals are submitted and approved by the Architect:

1. Project Schedule.
2. List of Subcontractors, materials, products.
3. Schedule of Values.
4. Submittal Schedule.

G. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. NC State Construction Forms "Contractor's Affidavit of Payment of Debts and Claims."
5. NC State Construction Forms "Contractor's Affidavit of Release of Liens."
6. NC State Construction Forms "Consent of Surety to Final Payment."
7. Summary of all MBE’s paid for project. Use Appendix E to Summarize.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

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

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

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

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Name of Product and Manufacturer to be provided by the Subcontractor.
5. Submit Subcontract List within 30 days of Notice to Proceed.

B. Key Personnel Names: Within 30 days of Notice to Proceed, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

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

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

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

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

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

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

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

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

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

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

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

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

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

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

7. Electrical Work: Show the following:

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

8. Fire-Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

1.7 REQUESTS FOR INFORMATION (RFIs)

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

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

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

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

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

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

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

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

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

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

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Contractor’s standard form acceptable to the Architect

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

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

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

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

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.

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

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

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

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

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

C. Progress Meetings: Architect will conduct progress meetings at monthly intervals.

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

a. Review outstanding items from previous minutes.
b. Contractors current status complete with written summary.
c. Contractors work to be performed next period, written summary.
d. Change Order status

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

1) Review schedule for next period.

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

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

D. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.

1.3 DEFINITIONS

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

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

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

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

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

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

1.4 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.
3. Two paper copies.

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

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

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

D. Daily Construction Reports: Submit at monthly intervals.

1.5 COORDINATION

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

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

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Project Acceptance.

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

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

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Pre-Final: Indicate completion in advance of date established for Project Acceptance and allow time for Architect's administrative procedures necessary to schedule Final Inspections.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

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

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

    a. Uninterruptible services.
    b. Use of premises restrictions.
    c. Environmental control.

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

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Building flush-out.
    m. Startup and placement into final use and operation.

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

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Pre-final inspections, and final completion, and the following interim milestones:

1. Temporary enclosure and space conditioning.
2. Power on Building.
3. Critical inspections such as under slab rough-in, above ceiling inspections, wall rough-ins, etc.

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

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

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

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.

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

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

2.3 REPORTS

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

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

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Architect within seven day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

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

C. Submit 5-year weather data for the previous 5-years at the beginning of the Project within 30 days of Notice to Proceed. Data shall indicate the average number of days per month with precipitation that will serve as baseline for any weather days to be claimed in excess of the 5-year averages.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

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

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

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

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

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

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

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

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

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

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

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

    b. Finalize the schedule such that all shop drawings required for the project are submitted within 90 days of Notice to Proceed.

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

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

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in Architects current AutoCAD version.
    c. Contractor shall sign Architect’s standard release form
    d. The following digital data files will by furnished for each appropriate discipline:

        1) Basic Floor plans.
        2) Basic Reflected ceiling plans.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

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

1. Initial Review: Allow 20 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 20 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 20 days for initial review of each submittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.
    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.

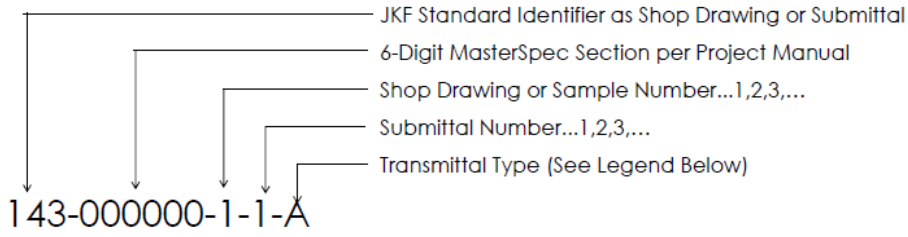
    a. Transmittal Form for Paper Submittals: Use Contractors Standard Transmittal.
    b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of Construction Manager.
        7) Name of Contractor.
        8) Name of firm or entity that prepared submittal.
        9) Names of subcontractor, manufacturer, and supplier.
        10) Category and type of submittal.

11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number, numbered consecutively.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

E. Electronic Submittals:(Limit to those submittals pre-approved for electronic submission by the Architect): Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file as follow:



Transmittal Type

A	Transmittal from GC
B	Transmittal from Architect to Consultant
C	Transmittal from Consultant to Architect
D	Transmittal Architect to GC
E	Transmittal Architect to Owner
SD	Shop Drawing (Actual Documents to be Reviewed)
PD	Product Data (Actual Documents to be Reviewed)

JKF

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect, containing the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of firm or entity that prepared submittal.

g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

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

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

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

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit up to 5 paper copies of each submittal unless otherwise indicated. Architect will return two copies.
3. Informational Submittals: Submit up to 5 paper copies of each submittal unless otherwise indicated. Architect will not return copies.

4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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

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

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

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

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

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.
    b. Up to 5 paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

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

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

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.
    b. Up to 5 opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

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

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

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

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

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

    a. Number of Samples: Submit 2 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

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

    a. Number of Samples: Submit three sets of Samples. Architect will retain 1 Sample sets; remainder will be returned.

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

E. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

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

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.

3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

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

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

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit up to 5 paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. Reviewed: Information submitted is in compliance with Contract Documents.
2. Reviewed as Noted: Information submitted is in compliance with Contract Documents except as noted.
3. Revise and Resubmit: Submittal does not meet Contract Documents or is incomplete, and must be resubmitted.
4. Not Reviewed: Incomplete submittal, was not required or does not require review.

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

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

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

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1. Specific quality-assurance and -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 tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

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

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

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

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

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

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

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If 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 conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.5 ACTION SUBMITTALS

A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

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

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

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

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

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

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

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

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

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

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

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified.

Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

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

1.8 REPORTS AND DOCUMENTS

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

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

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

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

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

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

D. Permits, Licenses, and Certificates: For 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.

1.9 QUALITY ASSURANCE

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

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

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

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

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

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

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

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

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

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

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

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

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

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

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

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

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

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

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

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

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

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

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

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

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

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

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

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

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

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

3.2 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Contractor Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Contractor Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Contractor will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Contractor shall pay for all temporary electrical, water, and sewer services required for the project. Coordinate any tap fees, electrical service fees, and/or impact fees with local utility companies and local jurisdiction.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. HVAC system isolation schematic drawing.
2. Location of proposed air-filtration system discharge.
3. Waste handling procedures.
4. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

C. Accessible Temporary Egress: Comply with applicable provisions in 2012 NC Building Code, the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
3. Drinking water.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. 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: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

J. Electronic Communication Service: Project electronic documents and maintain electronic communications and the following:

1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
2. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Project Acceptance in inspection. Remove before Project Acceptance. Personnel remaining after Project Acceptance will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Project Acceptance. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated on Drawing A8.1. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Elevator Use: See Section 142400 "Hydraulic Elevators" for temporary use of new elevators.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Project Acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Project Acceptance. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys each to Owner and Architect.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Project Acceptance.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Project Acceptance. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

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

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Project Acceptance.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

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

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

C. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Project Acceptance.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Project Acceptance.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Project Acceptance.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Project Acceptance procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Pre-Final.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Per State Construction Close-out List.

C. Certificate of Insurance: For continuing coverage.

D. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 PRE-FINAL PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Pre-Final Inspection by Architect: Complete the following a minimum of 7 days prior to requesting Architect's Pre-Final inspection. List items below that are incomplete at time of request.

1. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
2. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
3. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
4. Contractor's statement of completion with request for designer's Pre-Final inspection
5. Certificate of Occupancy by Local Authority Having Jurisdiction:
6. Installer's Fire Alarm System Record of Completion (Certification) as required by NFPA 72:
7. Installer's Sprinkler System Record of Material and Test Reports as required by:
    a. NFPA 13-(Sprinkler Systems)
    b. NFPA 14-(Standpipe and Hose Systems)
    c. NFPA 20-(Centrifugal Fire Pumps)
    d. Local Approval Letter of Sprinkler System Design
8. Dept. of Labor Approval for Elevator.
9. Dept. of Labor Approval for Boiler & Pressure Vessels
10. Domestic Water Test Report and Acceptance for Use:
11. Laboratory Hood Certification
12. Engineer's Approval of Test and Balance Report(TAB)
13. NEC Load Tests: Battery Powered Emergency Devices
14. Emergency Generator Load Test
15. Installer's Electrical Service Ground Test Report

C. Inspection: Submit a written request for Pre-Final inspection a minimum of 7 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.
3. A Final Inspection with State Construction will not be scheduled until the Contractor completes the punchlist items in particular all life-safety related items.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Complete all punchlist items from Pre-Final inspection.
2. Advise Owner of pending insurance changeover requirements.
3. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
5. Advise Owner of changeover in heat and other utilities.
6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
7. Complete final cleaning requirements, including touchup painting.

8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Procedures Prior to Final Acceptance: Complete the following a minimum of 7 days prior to requesting State Construction inspection for determining date of Final Acceptance. List items below that are incomplete at time of request.

C. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.

1. State Construction, the Architect, and the Owner may accept the Project and issue a Project Acceptance Form for minor items. These items are to be completed within 30 days after acceptance. Failure to complete the outstanding items will necessitate issuance of a 15 notice by the Architect, after which the Owner may initiate completion of the outstanding items and withhold any costs incurred from the Contractor’s final payment request.

2. Reinspection: If the Project is not accepted, request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties effective the day after Project Acceptance.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark 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 Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Project Acceptance for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

A. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Initial Manual Submittal: Submit draft copy of each manual at Pre-Final Inspection. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Project Acceptance and at least 7 days before commencing demonstration and training. Architect will return copy with comments.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.

8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Contractor.
e. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.

g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to.mp4 format file type, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

a. Name of Contractor/Installer.
b. Business address.
c. Business phone number.
d. Point of contact.
e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.

c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

END OF SECTION 017900

SECTION 033000 - 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. Slabs-on-grade.
3. Column wrap

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, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:
    a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
6. Vapor retarders.
7. Curing materials.
8. Joint fillers.
9. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.

6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
10. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
11. Intended placement method.
12. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

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."

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.
f. Permeability.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

A. 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:

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II

a. Fly Ash: ASTM C 618, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 15 mils (0.38 mm) thick.

B. 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 sieve and 0 to 5 percent passing a No. 8 sieve.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.8 CONCRETE MIXTURES, 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 independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials Percentages in subparagraphs below repeat ACI 301 limits for concrete exposed to deicing chemicals.

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Exposure Class: ACI 318 (ACI 318M) F0, S0, W0, C0.
2. Minimum Compressive Strength: 3000 psi at 28 days.
3. Maximum Water-Cementitious Materials Ratio: 0.50.
4. Slump Limit: 5 inches, plus or minus 1 inch.

B. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Exposure Class: ACI 318 (ACI 318M) F0, S0, W0, C0.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
4. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
5. Maximum Water-Cementitious Materials Ratio: 0.45
6. Slump Limit: 4 inches, plus or minus 1 inch.
7. Air Content for interior slabs: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Exterior Slabs-on-Grade and Column Wrap: Proportion normal-weight concrete mixture as follows:

1. Exposure Class: ACI 318 (ACI 318M) F2, S0, W0, C2.
2. Minimum Compressive Strength: 4500 psi at 28 days.
3. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
4. Maximum Water-Cementitious Materials Ratio: 0.40
5. Slump Limit: 4 inches, plus or minus 1 inch.
6. Air Content for exterior concrete: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 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.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.2 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 and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.3 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. 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.

3.4 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 as indicated into concrete.

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. 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- 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. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 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. 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.

3.7 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 in one direction.

1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

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 to receive trowel finish .

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 to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

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.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

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.

3.9 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six 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 deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.10 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 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 in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.

C. 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., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. 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 placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. 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.
8. 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.
9. 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.
10. 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.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Clay face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Clay face brick, in the form of straps of five or more bricks.
3. Weep holes/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.
2. Clay face brick, in the form of straps of five or more bricks.
3. Special brick shapes.
4. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
5. Cavity vents.
6. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.
   a. Include material test reports substantiating compliance with requirements.
   b. For masonry units 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.

D. 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.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 SPECIAL REQUIREMENTS

A. The Work of this Section shall be bid and provided as a single lump sum subcontract to the General Contractor (Square foot/ unit pricing of masonry labor and General Contractor furnished materials is not permitted). The Masonry Subcontractor shall be a firm, who specializes in masonry construction and shall furnish all materials, equipment, and labor required to complete the required masonry construction for this project.

B. Lump Sum Masonry Contractors through the General Contractor, shall upon request of the Architect/ Owner provide evidence of at least 5 years experience with 5 projects of equivalent size and scope of experience performing work as a Lump Sum Masonry Contracting Firm.

C. Masonry subcontractor shall not act as a broker, but shall perform the Work of this section with its own forces. Upon request of the Architect, General Contractor shall provide a copy of the Contract between General Contractor and Masonry Subcontractor (contract amounts may be omitted) indicating their contract is a lump sum contract.

D. Additionally, the work of this section shall be bid and performed by a firm certified as a "North Carolina Masonry Contractors Association Certified Masonry Contractor" as described in the most current version of the NCMCA's "Guide to Masonry Contractor Certification." (North Carolina Masonry Contractors Association, PO Box 3463, Hickory, NC 28603-3463, (828) 324-1564, information@ncmca.com) . The masonry subcontractor shall at all times when work is in progress, provide an individual from its own staff designated by the North Carolina Masonry Contractors Association Masonry Contractor Certification Program as a "CMP-Certified Masonry Professional" or "CME-Certified Masonry Executive" (as described in the most current version of the NCMCA's "Guide to Masonry Contractor Certification") on-site to supervise work in progress.

E. Definition: Lump Sum Masonry Subcontractor shall be a firm specializing in lump sum masonry contracting work and shall have been in masonry construction business for at least 5 years. Sub-contracting of masonry work is discouraged and if allowed the masonry subcontractor shall be responsible for the performance of its subs and shall continually supervise and inspect their work. The masonry subcontractor shall have a superintendent and crew chiefs (from its own staff) on site supervising all the masonry work.

1. A listing of masonry contractors capable of providing a lump sum bid is available from the North Carolina Masonry Contractor's Association at 828-324-1564 (828-324-2179, fax) or on the Internet at www.ncmca.com.

F. Daily preliminary cleaning of masonry is required for this project. The masonry subcontractor shall provide a person(s) to perform this task daily.

G. If final cleaning of the masonry is to be subcontracted, the masonry subcontractor shall be responsible to supervise the cleaning operations, coordinate the type and application of cleaning materials in accordance with specific manufacturer's written recommendations. Masonry subcontractor shall certify to the Owner through the Architect that the proper cleaners were used, at the proper application rates, and complied with manufacturer's recommendations.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each type of exposed unit masonry construction in sizes approximately 60 inches long by 60 inches high by full thickness, including face and backup wythes and accessories.
   a. Include a sealant-filled joint at least 16 inches long in each mockup.
   b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
   c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
   d. Include metal studs, sheathing, water-resistive barrier sheathing joint-and-penetration treatment, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
   e. Include clay face brick on one face of interior unit masonry wall mockup.
2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 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.

1.10 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners 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: Lightweight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 MASONRY LINTELS

A. General: Provide one of the following:

B. 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: MW or SW.

2. Type: FBX.
3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4150 psi.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
6. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
7. Application: Use where brick is exposed unless otherwise indicated.
8. Color and Texture: Provide full range of color (light gray, gray-beige range) for Architect's selection.

    a. Taylor.
    b. Belden.
    c. Boral.
    d. Triangle Brick.

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.

E. Mortar Cement: ASTM C 1329/C 1329M.

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.

G. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

I. 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.

J. Water: Potable.

2.8 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

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 steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet , with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multi-wythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.9 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes are of different materials, use adjustable ties with heavy-duty flattened errated pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 1/4-inch-diameter, hot-dip galvanized steel wire

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch-diameter, hot-dip galvanized steel wire.

E. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated] [bent to configuration indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M] [Epoxy coating 0.020 inch thick.

2.10 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
7. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
8. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
9. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
10. Solder metal items at corners.

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Laminated Stainless Steel Fabric Flashing. Non-Asphaltic: Use the following unless otherwise indicated:
2. Stainless steel core with polymer fabric laminated to stainless steel face with non-asphaltic adhesive. Stainless steel type: 304, ATM A167. Fabric: polymer fabric; laminated back face of stainless steel core.

    a. Products: Subject to compliance with requirements, provide the following:
        1) York Manufacturing, Inc.; Multi-Flash SS
        2) STS Coatings, Inc.; Gorilla Flash Stainless Fabric
        3) Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
        4) TK Products, Inc.; TK TWF

b. Accessories: Form the stainless steel flashing in the field or use 26 gauge stainless steel pre-manufactured corners

B. 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 fully concealed, use metal flashing and flexible flashing as detailed.

C. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

D. 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.

E. Termination Bars for Flexible Flashing: Stainless-steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.11 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.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vent Products: Use[one of] the following unless otherwise indicated:

1. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Configuration: Provide one of the following:
   a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.12 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.

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 mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. 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, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use 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 S.

D. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Cast-stone trim units.

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 2500 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. 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 or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch 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, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, 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 under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
   3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
   4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

   1. Bed face shells in mortar and make head joints of depth equal to bed joints.
   2. Bed webs in mortar in all courses of piers, columns, and pilasters.
   3. Bed webs in mortar in grouted masonry, including starting course on footings.
   4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
   5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Allow cleaned surfaces to dry before setting.
   3. Wet joint surfaces thoroughly before applying mortar.
   4. Rake out mortar joints for pointing with sealant.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, and air barriers unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:

   1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

      a. Where bed joints of both wythes align, use tab-type reinforcement.

   2. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Embed connector sections and continuous wire in masonry joints.
2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 18” inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

B. Provide not less than 2 ¼ inches of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 2 inches wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.

C. Form expansion joints in brick as follows:

1. Build in compressible joint fillers where indicated.
2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.

3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

E. Install cavity vents at 16 inches on center in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and

inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.15 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and 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.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.16 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

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. Structural steel.
2. Shrinkage-resistant grout.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 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 anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Shop primers.
3. Nonshrink grout.

F. Source quality-control reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

B. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

B. Headed Anchor Rods: ASTM F 1554, Grade 36, weldable, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain.

2.4 PRIMER

A. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
   1. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
   2. Mark and match-mark materials for field assembly.
   3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize all exterior steel, shelf angles and steel located in exterior walls.

2.9 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Galvanized surfaces.
4. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M. Test groove welds using the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field groove welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

3.6 REPAIRS AND PROTECTION

A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

B. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

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. K-series steel joists.
2. Joist accessories.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Manufacturer certificates.

D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of joist top chord extensions signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide joist top chord extensions capable of withstanding design loads indicated.

2.2 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, parallel top chord, and special sloped seats.

1. Joist Type: K-series steel joists.

B. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

C. Do not camber joists.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications"for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

C. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

D. Welding Electrodes: Comply with AWS standards.

E. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2.

B. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing 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

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications and "joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
2. Apply a compatible primer of same type as primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

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.

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.

1.5 QUALITY ASSURANCE

A. 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."

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G90 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.
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 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, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Galvanizing Repair Paint: ASTM A 780.

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. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. 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 arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: As indicated.
2. Weld Spacing: As indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds 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. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Project Acceptance.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - PRODUCTS

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; 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.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. 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. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

1.6 QUALITY ASSURANCE

A. 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.

B. 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 framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST50H.
2. Coating: G60.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50, Class 1.
2. Coating: G90.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Flange Width: 1 5/8inches.
3. Section Properties: As indicated.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch.

2. Flange Width: 1-1/2 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: 1 inch plus the design gap for one-story structures.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

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. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. 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.

D. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

2.7 FABRICATION

A. Fabricate cold-formed steel framing 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 framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    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 and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural 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 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

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 and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity 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 framing are secured.

G. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing:As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to bypassing studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 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 framing is without damage or deterioration at time of Project Acceptance.

END OF SECTION 054000

SECTION 055000 - 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. Metal downspout boots.
4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
5. Metal bollards.

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. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for operable 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. Metal downspout boots.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

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 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F 3125/F 3125M,Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A 563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; 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:

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe 1/4-inch wall-thickness rectangular steel tubing.

B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.

2.5 MISCELLANEOUS MATERIALS

A. 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.

B. 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.

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. 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.

G. 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.

2.6 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 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, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 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. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
2. Drill or punch girders and plates for field-bolted connections where indicated.
3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

F. Galvanize miscellaneous framing and supports where indicated.

G. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast aluminum in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Outlet: Vertical, to discharge into pipe.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with zinc-rich primer.

2.10 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 unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.11 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.

2.12 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. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. 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.

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.

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. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

C. 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.

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 dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b for exterior construction not in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide No. 2 grade lumber and the following species:
1. Mixed southern pine; SPIB.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M. Exposed to view connections shall be made with Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

F. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

G. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

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

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

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

END OF SECTION 061000

SECTION 061600 - SHEATHING

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. Soffit sheathing.
2. Sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 SOFFIT SHEATHING

A. Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: As noted.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
2. For roof wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

3. in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:

a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL 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. Plastic-laminate-clad architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

D. Samples for Initial Selection: For each type of exposed finish.

1. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For the following:
1. High-pressure decorative laminate.

1.6 QUALITY ASSURANCE

A. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Grade: Premium.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Abet Laminati Inc.
b. Lamin-Art, Inc.
c. Formica (Basis of Design)
d. Wilsonart.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.
5. Pattern Direction: As selected by architect from manufacturer’s full range of colors and patterns.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Architect from laminate manufacturer's full range.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Softwood Plywood: DOC PS 1, medium-density overlay.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

C. Catches: Magnetic catches, BHMA A156.9, B03141.

D. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement Resorcinol.

1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 071113 - 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 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Trowel Coats: ASTM D 1227, Type II, Class 1.

B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

D. VOC Content: Zero.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by 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.

1. Test for surface moisture according to ASTM D 4263.

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 over outside face of footing.

1. Extend dampproofing 12 inches 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-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 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 onto shelf angles supporting veneer.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.

B. Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.

C. Masonry Backup for Brick Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..

D. 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..

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 071113

SECTION 072100 - 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. Foam-plastic board insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 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 before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. DiversiFoam Products.
2. Dow Chemical Company (The).
3. Owens Corning, Formular High-R CW Plus (Basis of Design)
4. Type IV, 25 psi, 1.55 pcf density.
5. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing 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 indicated.

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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

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 in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches 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."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

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 072100

SECTION 072500 - WEATHER BARRIERS

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. Building wrap.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Chemical Company (The).
b. DuPont Building Innovations: E. I. du Pont de Nemours and Company.
c. Ludlow Coated Products.
d. Reemay, Inc.

2. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
4. Allowable UV Exposure Time: Not less than three months.
5. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 072500

SECTION 074113 - 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:
   1. Standing-seam metal roof panels.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified NC Professional Engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
   1. Test-Pressure Difference: Negative 1.57 lbf/sq. ft..

D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
   1. Test-Pressure Difference: 2.86 lbf/sq. ft.

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. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A-90.
   2. Hail Resistance: MH.

H. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Wind speed as indicated on Drawings.
   2. Snow Loads: Load indicated on Drawings.
   3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/240 of the span.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. 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, ambient; 180 deg F, material surfaces.

J. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

K. Energy Performance: Provide roof panels that are listed on the U.S. Department of Energy's ENERGY STAR Roof Products Qualified Product List for steep-slope roof products.

L. Energy Performance: Provide roof panels with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
   1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
      a. Flashing and trim.
      b. Gutters.
      c. Downspouts.

C. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
   2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
   3. Accessories: 12-inch- long Samples for each type of accessory.

E. Delegated-Design Submittal: For metal roof panel assembly 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. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installers of the items involved:
   1. Roof panels and attachments.
   2. Purlins and rafters.
   3. Roof-mounted items including bar joists, pipe and penetrations, and snow guards.

B. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in "Performance Requirements" Article.
   1. Submit evidence of meeting performance requirements.

C. Qualification Data: For qualified Installer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

E. Field quality-control reports.

F. Warranties: Samples of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal roof panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

C. Surface-Burning Characteristics: Provide metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to ASTM E 84 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.

D. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
   4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   5. Review structural loading limitations of deck during and after roofing.
   6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for metal roof panel assembly during and after installation.
9. Review roof observation and repair procedures after metal roof panel installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

E. Protect foam-plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.11 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies 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, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Five years from date of Project Acceptance.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof 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 Project Acceptance.

C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: 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 Project Acceptance.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Surface: Smooth, flat finish.
3. Exposed Coil-Coated Finish:
    a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. 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.

B. Panel Sealants:
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 wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. minimum density unless otherwise indicated; with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively. Insulation shall comply with Underwriters Laboratories (UL) Inc. Roof Deck Construction #457, tested in accordance with ANSI/UL Standard 1256. This application requires that the insulation be

capable of spanning across rib openings in the deck and provide reasonable resistance to foot traffic and other normal roof loads.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
      b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
      c. Henry Company; Blueskin PE200 HT.
      d. Metal-Fab Manufacturing, LLC; MetShield.
      e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Cold-Rolled Furring Channels: Minimum 1/2-inch- wide flange.
   1. Nominal Thickness: As required to meet performance requirements.
   2. Depth: As required.
   3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
   4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

C. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.
   1. Nominal Thickness: 0.025 inch.

D. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.5 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 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 intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.
   1. Basis-of-Design Product: Subject to compliance with requirements and ability to match existing building, provide Construction Metals Products or comparable product by one of the following:
      a. AEP-Span.
      b. Berridge Manufacturing Company.
      c. Merchant & Evans.
      d. Construction Metal Products, Inc.
      e. Metal Roofing System, Inc.
   2. Material: Zinc-coated (galvanized) steel sheet, 24 gauge nominal thickness.
      a. Exterior Finish: 2-coat fluoropolymer.
      b. Color: Metallic Silver.
   3. Batten: Same material, finish, and color as roof panels.
   4. Clips: Floating to accommodate thermal movement.
      a. Material: 0.064-inch- nominal thickness, zinc-coated (galvanized) steel sheet.
   5. Joint Type: Double folded.
   6. Panel Coverage: 16 inches.
   7. Panel Height: 2.0 inches.

2.7 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.8 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
   2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
   3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch thick. Provide flashing and trim as required to seal against weather and to provide finished

appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from same material roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.

2.9 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. 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 roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the 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. End Seams for Other Than Aluminum: Fabricate nonmoving seams 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 elastomeric sealant 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 of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.10 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 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, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

B. 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.

C. 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.

D. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Substrate Board: Install substrate boards over roof deck on entire roof surface. Attach with substrate-board fasteners.
   1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

C. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

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 over entire roof area, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

B. Apply slip sheet over underlayment before installing metal roof panels.

C. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.4 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation."
   1. Erect insulation and hold in place with Z-shaped furring members spaced 24 inches o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches o.c.

3.5 METAL ROOF PANEL INSTALLATION, GENERAL

A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.
   1. Point of Fixity: Fasten each panel along a single line of fixing located at eave
   2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.

C. Install metal roof panels as follows:
   1. Commence metal roof panel installation and install minimum of 300 sq. ft**.** in presence of factory-authorized representative.
   2. Field cutting of metal panels by torch is not permitted.
   3. Install panels perpendicular to purlins.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Provide metal closures at rake edges, rake walls and each side of ridge and hip caps.
   6. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
   7. Install ridge and hip caps as metal roof panel work proceeds.
   8. End Splices: Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
   9. Install metal flashing to allow moisture to run over and off metal roof panels.

D. Fasteners:
   1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.

E. 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.

F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
   1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.6 METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended 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.

3.7 METAL SOFFIT PANEL INSTALLATION

A. In addition to complying with requirements in "Metal Roof Panel Installation, General" Article, install metal soffit panels to comply with requirements in this article.

B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
   1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

C. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fascia meet soffits, along lower panel edges, and at perimeter of all openings.

3.8 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level 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 excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
   1. Provide elbows at base of downspouts to direct water away from building.
   2. Connect downspouts to underground drainage system indicated.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.9 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113

SECTION 074213 - FORMED METAL WALL 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:

1. Exposed-fastener, lap-seam metal wall panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review of procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 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.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

1. Include Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 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.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 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 metal panel assembly as shown on Drawings, including corner, supports, attachments, and accessories.
2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.
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 Project Acceptance.

1.8 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.

1.9 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.

1.10 COORDINATION

A. 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.

1.11 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 Project Acceptance.

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 Project Acceptance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and between major ribs.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Architectural Metal Systems.
b. Berridge Manufacturing Company.
c. Fabral.
d. MBCI.
e. McElroy Metal, Inc.
f. PAC-CLAD; Petersen Aluminum Corporation.
g. Construction Metal Products, Inc.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 0.034 inch.
b. Exterior Finish: Two-coat fluoropolymer.
c. Color: As selected by Architect from manufacturer's full range including metallic and silver grays.

3. Major-Rib Spacing: 6 inches o.c.
4. Panel Coverage: 36 inches.
5. Panel Height: 1.5 inches.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy 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 rakes, 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-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, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, 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. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

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 wide and 1/8 inch 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.

2.4 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. 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.

E. 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 wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 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 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.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. 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.

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 wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall 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 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. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch 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 wall panel manufacturer; or, if not indicated, provide types recommended by metal 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 are permanently watertight.

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 performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 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. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 074293 - METAL SOFFIT 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 metal soffit 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 flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

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.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. 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.

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 metal panel installation with rain drainage work, flashing, trim, construction of walls, 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 Project Acceptance.

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 Project Acceptance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal roof panels.

1. Finish: Match finish and color of metal roof panels.
2. Sealant: Factory applied within interlocking joint.

C. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Material: Same material, finish, and color as metal roof panels.
2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

    a. Nominal Thickness: 0.022 inch.
    b. Exterior Finish: Two-coat fluoropolymer.
    c. Color: As selected by Architect from manufacturer's full range including metallic and silver grays.

3. Panel Coverage: 12 inches.
4. Panel Height: 1.0 inch.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy 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, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal 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. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types 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 wide and 1/8 inch 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.

2.4 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. 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.

E. 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 Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. 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 soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 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 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.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. 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.

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 framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.

    a. Verify that air- or water-resistive barriers 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.

1. Soffit Framing: Wire tie or clip furring channels to supports.

3.3 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. 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. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

E. 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, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. 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 are permanently watertight.

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 to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 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. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074293

SECTION 077253 - SNOW GUARDS

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. Rail-type, seam-mounted snow guards.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

1. Include details of rail-type snow guards.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Structural Performance:

1. Snow Loads: As indicated on Drawings.

2.2 RAIL-TYPE SNOW GUARDS

A. Seam-Mounted, Rail-Type Snow Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
b. S-5! Attachment Solutions; Metal Roof Innovations, Ltd.

c. Snow Management Systems.
d. TRA SNOW & SUN, INC.

2. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with the number and type of rails to match the existing roof.
3. Material and Finish: Stainless steel; Match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare substrates for bonding snow guards.

B. Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

A. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.

B. Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
2. Seam-Mounted, Rail-Type Snow Guards: Stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

END OF SECTION 077253

SECTION 079200 - 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.

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

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

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 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.

1.5 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 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 Project Acceptance.

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 Project Acceptance.

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. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

B. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.

C. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 100/50, Uses T and NT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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.

2.5 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.6 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM 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 bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at all locations 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 of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM 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 Project Acceptance. 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 horizontal traffic surfaces.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, S, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints in unit masonry.
b. Joints between metal panels.
c. Joints between different materials listed above.
d. Perimeter joints between materials listed above and frames of doors windows and louvers.
e. Control and expansion joints in ceilings.
f. 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.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, S, P, 100/50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

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: Silicone, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
c. 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.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Around perimeter of floors, ceiling, and doors, in Clean Room, Dressing, and DCON.
d. 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.

G. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, S, P, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 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.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel doors and frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

C. 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 electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

D. Product Schedule: For hollow-metal doors and frames, 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.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B..

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule on Drawings.
   b. Thickness: 1-3/4 inches.
   c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
   d. Edge Construction: Model 1, Full Flush.
   e. Edge Bevel: Bevel lock and hinge edges 1/8 inch in 2 inches.
   f. Core: Manufacturer's standard.
   g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rateddoors.

2. Frames:

   a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
   b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

D. 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.

E. Mineral-Fiber Insulation: ASTM C665, 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 E136 for combustion characteristics.

2.5 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. 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. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.6 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 ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.

3. Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 REPAIR

A. 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.

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081213 - HOLLOW METAL 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 frames.

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, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
2. Locations of reinforcement and preparations for hardware.
3. Details of each different wall opening condition.
4. Details of anchorages, joints, field splices, and connections.
5. Details of moldings, removable stops, and glazing.
6. Details of conduit and preparations for power, signal, and control systems.

C. 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 frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

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.

1. Provide additional protection to prevent damage to factory-finished units.

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-high wood blocking. Provide minimum 1/4-inch space between each unit to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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 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 FRAMES

A. Construct interior frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Hollow-Metal Frames: NAAMM-HMMA 860..

1. Physical Performance: Level A according to SDI A250.4.
2. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
3. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

2.5 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. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 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 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 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. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

4. 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.

C. 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 frames to receive nontemplated, mortised, and surface-mounted hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

D. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior frames.
3. Provide loose stops and moldings on inside of hollow-metal work.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 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.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

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 frames to receive nontemplated, mortised, and surface-mounted 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 frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
3. 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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. 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 o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: 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. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081213

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Insulated exterior service doors.
   2. Interior Service doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   3. Include description of automatic-closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   5. Show locations of controls, locking devices, and other accessories.
   6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

   1. Curtain slats.
   2. Bottom bar with sensor edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors 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 for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Project Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: As indicated on Drawings.
2. Testing: According to ASTM E 330/E 330M.
3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.3 DOOR ASSEMBLY (DOOR GROUP #6)

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACME Rolling Doors.
b. Clopay Building Products.
c. Cookson Company.
d. Overhead Door Corporation.
e. Raynor.
f. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.

D. STC Rating: 26.

E. Curtain R-Value: 7.7.

F. Door Curtain Material: Stainless steel.

G. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.

1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

H. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from stainless steel and finished to match door.

I. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats.

J. Hood: Match curtain material and finish.

1. Shape: Round.
2. Mounting: Face of wall.

K. Locking Devices: Equip door with slide bolt for padlock and chain lock keeper.

L. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
4. Motor Exposure: Exterior, wet, and humid.
5. Motor Electrical Characteristics:

a. Horsepower: 2 hp.

b. Voltage: 115-V ac, single phase, 60 Hz.

6. Emergency Manual Operation: Chain type.
7. Obstruction-Detection Device: Automatic pneumatic sensor edge on bottom bar.

a. Sensor Edge Bulb Color: Black.

8. Control Station(s): Interior mounted.

M. Curtain Accessories: Equip door with weatherseals pull-down strap poll hook and automatic-closing device Insert item.

N. Door Finish:
1. Stainless Steel Finish: ASTM A480/A480M No. 4 (polished directional satin).
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Stainless Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch; and as required.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Stainless Steel: 0.025-inch-thick, stainless steel sheet, Type 304, complying with ASTM A 666.

2.7 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Chain Lock Keeper: Suitable for padlock.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.

B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.9 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

D. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.

1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: ASTM A480/A480M No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.6 DEMONSTRATION

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

END OF SECTION 083323

SECTION 084213 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior framing.
2. Exterior Aluminum FRP Doors.
3. Exterior Aluminum Entrance Doors.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and by thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.

2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressre difference of 20 percent of positive wind-load design pressure, but not less then 6.24 lbf/sq. ft.

G. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

1. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    b. Low Exterior Ambient-Air Temperature: 0 deg F.

3. Interior Ambient-Air Temperature: 75 deg F.

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 > when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

K. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:

1. Sound Transmission Class (STC): Minimum 26 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
2. Outdoor-Indoor Transmission Class (OITC): Minimum 26 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

1.5 PERFORMANCE REQUIREMENTS- FRP Doors

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
B. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.
C. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 2.6 foot-pounds per inch of notch.
D. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 7,500 psi.
E. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 16,900 psi.
F. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.63 percent after 24 hours.
G. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 38.
H. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.022 average weight loss percentage.
I. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.
J. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.
K. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.
L. Thermal and Humid Aging, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Flashing and drainage.

F. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project. All design and shop drawings to be signed and sealed by a NC Professional Engineer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and the NC Accessibility Code Volume I-C.

F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.

e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components.

2. Warranty Period: Ten years from date of Project Acceptance.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Project Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following for Aluminum doors and storefront:

1. Commercial Architectural Products, Inc.
2. EFCO Corporation; (Basis for Design, 433T Storefront Framing (U.N.O.), D300 Aluminum Entrance Doors, and 402 Storefront at Mechanical Room doors)
3. Kawneer North America; an Alcoa company.
4. United States Aluminum.
5. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
6. YKK AP America Inc.
7. Special-Lite (Basis for Design FRP Doors)

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: As indicated.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 ALUMINUM ENTRANCE DOOR SYSTEMS

A. General: Major portions of the door sections shall have .125" (3 mm) wall thickness. Glazing stop sections shall have .050" (1.2 mm) wall thickness.

B. Entrance Doors: Door stiles shall be no less than 6” wide (not including glass stops).

C. Door stiles and rails shall have hairline joints at corners. Heavy concealed reinforcement brackets shall be secured with screws and shall be of deep penetration and fillet welded.

D. All doors shall have an adjusting mechanism in the top rail to provide for minor clearance adjustments.

E. Weather stripping shall be wool pile and shall be installed in one stile of pairs of doors and in jamb stiles of center pivoted doors.

F. Door stops shall include a bulb weather-strip that complies with ASTM E 2203 specification.

G. Glazing: All units shall be dry glazed with extruded pressure fitting aluminum glazing stops, and a gasket that complies with ASTM E 2203 specification.

H. Finish: Clear Anodic

2.5 FRP ENTRANCE DOOR SYSTEMS

A. Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets

B. Construction:
   1. Door Thickness: 1-3/4 inches.
   2. Stiles and Rails: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T5 alloy recovered from industrial processes, minimum of 2-5/16-inch depth.
   3. Corners: Mitered.
   4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom integral to standard tubular shaped stiles and rails reinforced to accept hardware as specified
   5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
   6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
   7. Rail caps or other face sheet capture methods are not acceptable.
   8. Extrude top and bottom rail legs for interlocking continuous weather bar.
   9. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
   10. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded locking edge of bottom rail.
   11. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.

C. Face Sheet:
   1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout.
   2. Protective coating: Abuse-resistant engineered surface. Provide FRP with SpecLite3 protective coating, or equal.
   3. Texture: Pebble.
   4. Color: As selected from full range of all available colors.
   5. Adhesion: The use of glue to bond face sheet to foam core is prohibited.

D. Core:
   1. Material: Poured-in-place polyurethane foam.
   2. Density: Minimum of 5 pounds per cubic foot.
   3. R-Value: Minimum of 9.

E. Cutouts:
   1. Manufacture doors with cutouts for required vision lites, louvers, and panels.
   2. Factory install vision lites, louvers, and panels.

F. Hardware:
   1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
   2. Factory install hardware.

2.6 ENTRANCE DOOR HARDWARE

A. Weather Stripping: Manufacturer's standard replaceable components.

   1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
   2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

B. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of **250** g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

G. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

    a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 085113 - 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 in size.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. 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. Field quality-control reports.

D. 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.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 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 Project Acceptance.
b. Glazing Units: 10 years from date of Project Acceptance.
c. Aluminum Finish: 10 years from date of Project Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **EFCO 590X** or a comparable product by one of the following:

1. EFCO Corporation.
2. Graham Architectural Products Corp.
3. Kawneer; an Alcoa Company.
4. KAWNEER.
5. YKK AP America Inc.

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: 80.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F.

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 74.

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, ambient; 180 deg F material surfaces.

G. Sound Transmission Class (STC): Rated for not less than 36 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Fixed.

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: Glass and Glazing Materials: Refer to Division 08 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

E. 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 broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. 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. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. 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.

G. Window Assemblies: Provide fixed units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:

1. Angled mullion posts with interior and exterior trim.
2. Angled interior and exterior extension and trim.
3. Exterior head and sill casings and trim.

H. 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, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

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 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

    a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
    b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

    a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
    b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.4 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 085113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.3 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.5 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. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

C. Samples for Initial Selection: For each type of exposed finish.

D. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch 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.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

E. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. 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.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Fastenings and other installation information.
e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
f. Mounting locations for door hardware.
g. List of related door devices specified in other Sections for each door and frame.

F. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, 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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult 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 schedule.
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 an Architectural Hardware Consultant (AHC).

1.9 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 to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.10 WARRANTY

A. Special Warranty: 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 Project Acceptance unless otherwise indicated below:

a. Manual Closers: 10 years from date of Project Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from 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.

2.2 PERFORMANCE REQUIREMENTS

A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

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.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/4 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3.

2.4 HINGES

A. Hinges: BHMA A156.1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Baldwin Hardware Corporation.
c. Hager Companies.
d. McKinney Products Company; an ASSA ABLOY Group company.
e. PBB, Inc.

2.5 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. 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. Allegion plc.
b. Hager Companies.
c. McKinney Products Company; an ASSA ABLOY Group company.
d. PBB, Inc.
e. Pemko Manufacturing Co.
f. Select Products Limited.

2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: See Schedule.
2. Levers: Cast.

3. Escutcheons (Roses): Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

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.

F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

    a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
    b. SARGENT Manufacturing Company; ASSA ABLOY.
    c. Yale

2.7 AUXILIARY LOCKS

A. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

2.8 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch 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. Allegion plc.
    c. Door Controls International, Inc.
    d. Hager

2.9 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. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
    b. SARGENT Manufacturing Company; ASSA ABLOY.
    c. Yale

2.10 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.11 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Existing System:

    a. Master key or grand master key locks to Owner's existing system.

B. Keys: Nickel silver.

2.12 KEY CONTROL SYSTEM

A. Key Lock Boxes: Designed for storage of 20 keys.

2.13 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Hager Companies.
    c. Hiawatha, Inc; a division of the Activar Construction Products Group.

2.14 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.

2.15 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 instructions 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. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    c. SARGENT Manufacturing Company; ASSA ABLOY.

2.16 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.17 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg, as follows:

1. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.18 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. Pemko Manufacturing Co.
c. Reese Enterprises, Inc.
d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

2.19 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; 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. Allegion plc.
b. Hager Companies.
c. Hiawatha, Inc; a division of the Activar Construction Products Group.
d. Pawling Corporation.

2.20 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location 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. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.21 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, wall and floor construction, and other conditions affecting performance of the Work.

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 door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and 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's "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 work. 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 of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

E. Key Control System:
1. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above 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.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

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 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. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.5 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 Project Acceptance.

3.6 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.

3.7 DOOR HARDWARE SCHEDULE

Door Hardware Set No. 1
Exterior Aluminum Doors

1	Cont. Hinges	Hager, 14 GA	780-111HD	304
1	Exit Device	Corbin-Russwin	ED5200A-08-ASM	630
1	Closers	Corbin-Russwin	DC6210xA3	689
1	Cylinder	Corbin Russwin		
1 set	Weatherstrip	By Alum. /FRP Manuf.		
1	Threshold	Pemko	2005-AT	

Door Hardware Set No. 2
Exterior Aluminum/FRP Doors

1	Cont. Hinges	Hager, 14 GA	780-111HD	304
1	Lockset-Entrance	Corbin-Russwin	ML2051	630
1	Closers	Corbin-Russwin	DC6210xA3	689
1	Cylinder	Corbin Russwin		
1 set	Weatherstrip	By Alum. /FRP Manuf.		
1	Threshold	Pemko	2005-AT	

Door Hardware Set No. 3
Exterior Pair FRP Doors

2	Cont. Hinges	Hager, 14 GA	780-111HD	304
2	Manual Flush Bolt	Hager	281Dx2	
2	Closers/Hold Opens	Corbin-Russwin	DC6210xA2 w/Hold-Open	689
1	Lockset –Storage	Corbin-Russwin	ML2057-ASM-M25	630
1	Cylinder	Corbin Russwin		
1 set	Weatherstrip	By Alum. /FRP Manuf.		
1	Threshold	Pemko	2005-AT – Full Width	

Door Hardware Set No. 4

Interior Hollow Metal

1.5	Pr. Hinges	Hager	BB1168, 4 ½" x 4 ½"	
1	Closer	Corbin-Russwin	DC6210	689
1	Push-Pull	Hager #4G 4x12 Push	4x12 Push Plate	US26
2	Kickplate	12"x1"LDW		630
1	Door Bumper	Hager	234D	

Door Hardware Set No. 5

Interior Hollow Metal

1.5	Pr. Hinges	Hager	HT BB1168, 4 ½" x 4 ½"	
1	Lockset – Classroom	Corbin-Russwin	ML2051-ASM	630
1	Cylinder			
2	Kickplates	Hager, 12"x1"LDW		
1	Door Bumper	Hager	234D	

Door Hardware Set No. 6

Interior Hollow Metal

1.5	Pr. Hinges	Hager	HT BB1168, 4 ½" x 4 ½"	
1	Lockset – Storage	Corbin-Russwin	ML2057-ASM-M25	630
1	Cylinder			
2	Kickplates	Hager, 12"x1"LDW		
1	Door Bumper	Hager	234D	

END OF SECTION 087100

SECTION 088000 - 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, glazed curtain walls.
2. Glazing sealants and accessories.

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. 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 the following products; 12 inches square.

1. Tinted glass.
2. Coated glass.
3. Insulating glass.

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Product Test Reports: For tinted glass, coated glass, insulating glass, and glazing sealants, for tests performed by a qualified testing agency.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 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.

1.8 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.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Project Acceptance.

B. 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 Project Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. GGI; General Glass International.
    b. PPG Industries, Inc.
    c. Vetrotech Saint-Gobain.
    d. 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. 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. 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, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. 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 insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. 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.
3. 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.
4. 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 or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

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.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. 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.

C. 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.

D. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

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 polyisobutylene and silicone primary and secondary sealants.
2. Spacer: Aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

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. Field-applied sealants shall have a VOC content of not more than 250 g/L.
4. Sealants shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

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.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 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, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

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.

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 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 Project Acceptance. 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, tinted insulating glass.

1. Basis-of-Design Product: PPG, Solarban 70 Optigray + Clear.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Tinted fully tempered float glass.
5. Tint Color: Optigray Gray.
6. Interspace Content: Manufacturer's Standard.
7. Indoor Lite: Clear fully tempered float glass.
8. Low-E Coating: Sputtered on second surface.
9. Winter Nighttime U-Factor: 0.28 maximum.
10. Summer Daytime U-Factor: 0.24 maximum.
11. Visible Light Transmittance: 46% percent minimum.
12. Solar Heat Gain Coefficient: 0.23 maximum.
13. Light to Solar Gain (LSG): 2.00.
14. Safety glazing required.

END OF SECTION 088000

SECTION 088300 - MIRRORS

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 the following types of silvered flat glass mirrors:

1. Tempered glass mirrors qualifying as safety glazing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of the following products:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches long.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

B. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

C. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.

D. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

1. Nominal Thickness: 5.0 mm

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Adhesive shall have a VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.

2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.062 inch.

3. Finish: Clear bright anodized.

B. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.

C. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

D. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Rounded polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Wall-Mounted Mirrors: Install mirrors with mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Project Acceptance. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.
2. Blank-off panels for louvers

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Sample Warranties: For manufacturer's special warranties.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. 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. Warranty Period: 20 years from date of Project Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Airline Louvers; a division of Mestek, Inc.
b. Airolite Company, LLC (The).
c. Arrow United Industries.
d. Construction Specialties, Inc.
e. Greenheck Fan Corporation.
f. Louvers & Dampers, Inc.; a division of Mestek, Inc.
g. Ruskin Company.

2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

a. Free Area: Not less than 8.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
b. Point of Beginning Water Penetration: Not less than 1000 fpm.
c. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area exhaust velocity.
d. Air Performance: Not more than 0.15-inch wg static pressure drop at 1000-fpm free-area intake velocity.
e. See Mechanical Drawings for Louver Schedule, Final Sizes, and Free Area Requirements.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening at relief louvers and Bird screen at intake louvers.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2. Bird Screening: Aluminum, 1/2 inch by 0.063 inch (13 mm by 1.5 mm), expanded and flattened. Frame: Removable.

2.4 BLANK-OFF PANELS

A. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 1 inch.
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
3. Insulating Core: extruded-polystyrene foam.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same type of finish applied to louvers, but black color.
7. Attach blank-off panels with clips or sheet metal screws.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with fully recessed mullions at corners.

G. Provide subsills made of same material as louvers for recessed louvers.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **25** percent.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized, unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.018 inch U.N.O.
b. Depth: As indicated on Drawings

2. Dimpled Steel Studs and Runners:

a. Minimum Base-Metal Thickness: As indicated on Drawings or 0.015 inch.
b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: As indicated on Drawings or 0.018 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.018 inch.
2. Depth: 7/8 inch.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.018 inch.
b. Depth: 2-1/2 inches.

3. Dimpled Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.015 inch.
b. Depth: 2-1/2 inches.

4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 0.018 inch.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
b. Multilayer Application: 16 inches o.c. unless otherwise indicated.
c. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

D. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum Company.
5. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

2.4 SPECIALTY GYPSUM BOARD

A. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Thickness: 5/8 inch.
2. Mold Resistance: ASTM D 3273, score of 10.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Pecora Corporation; AC-20 FTR.
d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
e. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly.
3. Cementitious backer board: Behind all ceramic tile locations

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

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. Porcelain tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Crack isolation membrane.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.

3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Waterproof membrane.
3. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

A. Ceramic Tile Type CT1: Semi polished porcelain wall tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Olean; a division of Dal-Tile Corporation.
b. Daltile.
c. Trinity Tile (Basis of Design, Social).

2. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
3. Module Size: 24 by 48 inches.
4. Tile Color and Pattern: As selected by Architect from manufacturer's full range.

5. Grout Color: As selected by Architect from manufacturer's full range.
6. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. External Corners: Metal trim by Schluter (anodized aluminum).
    b. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

B. Ceramic Tile Type CT2: Unglazed floor tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Olean; a division of Dal-Tile Corporation.
    b. Daltile.
    c. Trinity Tile (Basis of Design, Chatham).

2. Face Size: 12 by 12 inches.
3. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
4. Grout Color: As selected by Architect from manufacturer's full range.
5. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. External Corners: Metal trim by Schluter (anodized aluminum).
    b. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

C. Ceramic Tile Type CT3: Unglazed Cove Base.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Olean; a division of Dal-Tile Corporation.
    b. Daltile.
    c. Trinity Tile (Basis of Design, Chatham).

2. Face Size: 6 by 12 inches.
3. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
4. Grout Color: As selected by Architect from manufacturer's full range.
5. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. External Corners: Metal trim by Schluter (anodized aluminum).
    b. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Slate Thresholds: ASTM C 629/C 629M, Classification II Interior, with fine, even grain and honed finish.

1. Description: Uniform, gray stone and unfading.

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with fabric reinforcement facing; 0.040-inch nominal thickness.

2.6 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

C. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.7 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Bullnosed, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Porcelain Tile: 1/8 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).
2. Do not extend waterproofing under thresholds set in modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on waterproofing with elastomeric sealant.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Ceramic Tile Installation: TCNA F121 and ANSI A108.1B; cement mortar bed (thickset) on waterproof membrane.
      a. Ceramic Tile Type: CT.
      b. Bond Coat for Cured-Bed Method: Latex- portland cement mortar.
      c. Grout: Water-cleanable epoxy grout.
      d. Location: As noted.

B. Interior Floor Installations, Concrete Subfloor:

   1. Ceramic Tile Installation: TCNA F122; thinset mortar on waterproof membrane.

      a. Ceramic Tile Type: As noted.
      b. Thinset Mortar: Modified dry-set mortar.
      c. Grout: Water-cleanable epoxy grout.

C. Interior Wall Installations, Masonry or Concrete:

   1. Ceramic Tile Installation: TCNA W202; thinset mortar.

      a. Ceramic Tile Type: As noted.
      b. Thinset Mortar: Modified dry-set mortar.
      c. Grout: Water-cleanable epoxy grout.

D. Interior Wall Installations, Wood or Metal Studs or Furring:

   1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.
      a. Thinset Mortar: Modified dry-set mortar.
      b. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

SECTION 095113 - 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 interior ceilings.

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 in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

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 Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system 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: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 450 or less.

2.3 ACOUSTICAL PANELS

A. Basis of Design Product: Subject to compliance with requirements, provide Armstrong World Industries, “Cirrus Tegular High NRC #556”, or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. Tectum Inc.
5. USG Interiors, Inc.; Subsidary of USG Corporation

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
2. Pattern: E (Lightly textured).

C. Color: White.

D. Light Reflectance (LR): Not less than 0.85.

E. Ceiling Attenuation Class (CAC): Not less than 35.

F. Noise Reduction Coefficient (NRC): Not less than 0.75.

G. Edge/Joint Detail: Beveled, Tegular.

H. Thickness: 3/4 inch.

I. Modular Size: 24 by 24 inches.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, 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, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

B. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled 15/16 inch steel sheet electrolytically zinc coated, with prefinished flanges of width indicated.

1. Structural Classification: Heavy-duty system.
2. Face Finish: Painted white.

C. 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. 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 hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. 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 0.135-inch-diameter wire.

E. Hanger Rods Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.5 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 Corp.
3. Chicago Metallic Corporation.
4. Gordon, Inc.
5. USG Interiors, Inc.; Subsidiary of USG Corporation.

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 circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.6 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following

1. Acoustical Sealant for Concealed Joints:

a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
b. Pecora Corporation; AIS-919.
c. Tremco, Inc.; Tremco 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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

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. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure 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.
4. 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.
5. 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.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

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 o.c. and not more than 3 inches from ends. 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 precise fit.
1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. 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.
3. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - 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 molding accessories.

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, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

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 for every 500 linear feet 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 or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.

2. During installation.
3. 48 hours after installation.

B. After installation and until Project Acceptance, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Product Standard: ASTM F 1861, NSF 332, Group I (solid, homogeneous).

B. Thickness: 0.125 inch.

C. Height: 5-1/4" inches.

D. Profile: Impulse #15 by Roppe, (Basis of Design); or provide comparable product by Johnsonite or Armstrong.

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 MOLDING ACCESSORY

A. Description: Rubber carpet edge for glue-down applications, nosing for resilient flooring material.

B. Locations: Provide rubber molding accessories in areas indicated.

C. Colors and Patterns: As selected by Architect from full range of industry colors.

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 resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. 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 surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Project Acceptance.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

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. Luxury vinyl floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples: Full-size units of each color, texture, and pattern of floor tile required.

D. Samples for Initial Selection: For each type of floor tile indicated.

E. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.8 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 or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Project Acceptance, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURYVINYL FLOOR TILE(LVT)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mohawk Group
2. Mannington
3. J + J Flooring
4. Shaw (Basis of Design, Set Up Collection, No. 24520 Dynamic)

B. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.

2. Type: B, Embossed Surface.

C. Thickness: 0.098 inches.

D. Size: 24 by 24 inches.

A. Colors and Patterns: As indicated by Architect from full range of industry colors and patterns. Allow for multiple colors and patterns.

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.

1. Adhesives shall comply with the following for VOC content: Vinyl Composition Tile Adhesives: 50 g/L or less.

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 alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile 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. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a 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 floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis in pattern indicated.

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 direction alternating in adjacent tiles (basket-weave pattern).

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 installation 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 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 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.

END OF SECTION 096519

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel.
2. Galvanized metal.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

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

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

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional **5** percent, but not less than 1 gal. of each material and color applied.

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. Duron, Inc.
3. ICI Paints.
4. Porter Paints.
5. PPG Architectural Finishes, Inc.
6. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

2.4 EXTERIOR ALKYD PAINTS

A. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

1. VOC Content: E Range of E1.

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 work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 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 plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. 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.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 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. Steel Substrates:

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.

c. Topcoat: Exterior alkyd enamel (gloss).

B. Galvanized-Metal Substrates:

1. Alkyd System: MPI EXT 5.3B.

a. Prime Coat: Cementitious galvanized-metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (gloss).

END OF SECTION 099113

SECTION 099123 - 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 masonry units (CMUs).
2. Steel and iron.
3. Galvanized metal.
4. Gypsum board.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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 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: For each product indicated, included the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

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

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

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg. F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg. F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional **5** percent, but not less than 1 gal. of each material and color applied.

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. Duron, Inc.
3. ICI Paints.
4. Porter Paints.
5. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Shellacs, Clear: VOC not more than 730 g/L.
6. Shellacs, Pigmented: VOC not more than 550 g/L.
7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
9. Floor Coatings: VOC not more than 100 g/L.
10. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
11. Dry-Fog Coatings: VOC content of not more than 400 g/L.
12. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

D. Colors: As selected by Architect from manufacturer's full range. Allow for up to two colors in each room for walls.

2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

2.4 METAL PRIMERS

A. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E1.

B. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

2.5 LATEX PAINTS

A. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 5.

B. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 5.

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. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations 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.

2. Do not paint over labels of independent testing agencies or equipment names, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulates.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

E. 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.

F. 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.

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.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 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. CMU Substrates:

1. High-Performance Architectural Latex System:

a. Block Filler: Block filler, latex, interior/exterior.

b. Prime Coat: Primer, alkali resistant, water based.

c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

d. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5).

B. Steel Substrates:

1. High-Performance Architectural Latex System MPI INT 5.1R:

    a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

    c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5).

C. Galvanized-Metal Substrates:

1. High-Performance Architectural Latex System MPI INT 5.3M:

    a. Prime Coat: Primer, galvanized, water based, MPI #134.

    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

    c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5).

D. Gypsum Board Substrates:

1. High-Performance Architectural Latex System MPI INT 9.2B:

    a. Prime Coat: Primer sealer, latex, interior.

    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

    c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5).

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

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 application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

a. Steel.

1.3 DEFINITIONS

A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

B. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

A. Concrete Stain Mockups:

1. Construct a 10 foot by 10 foot mockup at location selected by Architect.
2. Provide individual mockups for each color and pattern required.
3. Construct mockup using materials, processes, and techniques required for the work, including curing procedures. Incorporate representative control, construction, and expansion joints according to Project requirements. Installer for the work to construct mockup.
4. Mockup to be stained and sealed by the Installer who will actually perform the work for the Project. Record the amount of chemical stain needed per square foot of application to establish coverage rates for the work.
5. Notify Architect and Owner a minimum of seven calendar days in advance of the date scheduled for each mockup construction.
6. Obtain the Architect's and Owner's acceptance of each mockup prior to commencement of the work.
7. Each mockup to remain until completion of the work to serve as a quality control standard for the work. Provide suitable protections to preclude damage to mockup.Demolish and remove each mockup from site when directed.

B. Mockups: Apply mockups of each coating system indicated 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 coating system specified in Part 3.
    a. 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 Project Acceptance.

1.7 PREINSTALLATION CONFERENCE

A. Seven calendar days prior to scheduled date of installation, conduct a meeting at Project site to discuss requirements, including application methods. Attendees to include Architect, Owner, Contractor, Installer, and manufacturer's authorized field representative.

1.8 DELIVERY, STORAGE, AND HANDLING

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

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

1.9 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior coatings applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Colors: As selected by Architect from manufacturer's full range of colors.

2.2 METAL PRIMERS

A. Epoxy Zinc Primer: MPI #20.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Coronado Paint; Polyamide Epoxy Zinc Rich Primer, 101-152.
b. ICI Paints; Devoe Coatings, Catha-Cote, 313.
c. Parker Paint Mfg. Co. Inc.; Ameron, Amercoat Zinc Rich Epoxy Primer, 68HS.
d. Porter Paints; Porterzinc 3000, Zinc Rich Epoxy Primer, 3000.
e. PPG Architectural Finishes, Inc.; Aquapon Epoxy Zinc Rich Primer, 97-670.

f. Sherwin-Williams Company (The); Industrial & Marine, Zinc Clad IV, B69A8/V8.

2. VOC Content: Minimum E Range of **E1**

2.3 EPOXY COATINGS

A. Epoxy, Cold-Cured, Gloss: MPI #77.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Benjamin Moore & Co.; Polyamide Epoxy Coating, M36/M37.
b. Coronado Paint; Polyamide Epoxy Coating, 101 Line.
c. ICI Devoe, Devran 724, 724-KXXXX.
d. Porter Paints; Porterglaze 4000, Gloss Epoxy, 4000.
e. PPG Architectural Finishes, Inc.; Aquapon, Epoxy Cold Cured Gloss, 95-1.

3. VOC Content: Minimum E Range of **E1**.

2.4 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

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.

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Concrete: 12 percent.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates 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 coatings, 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 coating systems indicated.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.5 MAINTENANCE

A. Maintain chemically stained and sealed floors by sweeping. Clean spills when they occur and rinse dirt off with water. Wet-clean heavily soiled areas by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high quality commercial detergent. Maintain interior floors that require polishing by using a compatible, premium-grade, emulsion-type, commercial floor polish, according to manufacturer's printed instructions and safety requirements

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Polyurethane, Pigmented, Over Epoxy Coating System:

a. Prime Coat: Epoxy zinc primer, MPI#20
b. Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
c. First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
d. Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.

END OF SECTION 099600

SECTION 101100 - 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. Glass markerboards.

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.
   3. Include sections of typical trim members.

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.
   4. Include accessory Samples to verify color selected.

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, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6-inch-long sections of each trim profile.
   3. Display Rail: 6-inch-long section of each type.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 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.

1.7 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.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 GLASS MARKERBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-1 Visual Systems.
2. Claridge Products and Equipment, Inc.
3. Clarus Glassboards, LLC.

B. Glass Markerboards: 6-mm tempered glass markerboard, with smooth polished edge and eased corners; color coated on back surface with steel backing for use with magnets.

C. Mounting: Concealed mounting, manufacturer’s standard..

D. Color and Surface: Glossy in colors selected by the Architect from full-range of manufacturer’s colors.

E. Marker Tray: Magnetic.

2.3 MATERIALS

A. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

B. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.4 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.

2.5 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. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints.
2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

C. Sliding Visual Display Units: Install units at mounting heights indicated. Attach to wall framing with fasteners at not more than 16 inches o.c.

1. Adjust panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

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 101100

SECTION 101423 –PANEL 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. This Section includes the following:

1. Panel 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 indicated.

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. Polycarbonate sheet.
4. Fiberglass sheet.
5. 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. Panel Signs: Not less than 12 inches square including border.

E. Sign Schedule: Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

B. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 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.

1.8 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fiberglass Sheet: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with a minimum tensile strength of 15,000 psi when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi when tested according to ASTM D 790.

B. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

C. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:

1. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
2. Tensile Strength: 9000 lbf/sq. in. per ASTM D 638.
3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
4. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.

D. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. APCO Graphics, Inc.
4. ASI-Modulex, Inc.
5. Best Sign Systems Inc.
6. Gemini Incorporated.
7. Mohawk Sign Systems.
8. Avali's Wayfinding Solutions, Inc,

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. Melamine Plastic Laminate, All signs 0.25 inch thick.
2. Edge Condition: Square cut.
3. Corner Condition: Square.
4. Mounting: Unframed.
    a. Wall mounted with two-face tape.
    b. Manufacturer's standard anchors for substrates encountered.
5. Color: As selected by Architect from manufacturer's full range.
6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

C. Exterior 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. Melamine Plastic Laminate, 0.250-inch thick.
2. Edge Condition: Square cut.
3. Corner Condition: Square.
4. Mounting: Unframed.
    a. Wall mounted.
    b. Manufacturer's standard noncorroding anchors for substrates encountered.
5. Color: As selected by Architect from manufacturer's full range.

D. Panel Sign Schedule (Mohawk Sign Systems, Inc. –Basis for Design):

1. PS #1: Room Identification Sign with Braille.
    a. Sign Size: 6"x6"x ¼".
    b. Message Panel Material: Interior Panel Sign, Series 300.
    c. Text/Message: Room #.
    d. Location: As directed in the field by Architect.
    e. Quantity: Provide one per interior non-occupied room such as Mechanical, Data, Electrical Rooms, Janitor's Closet.

2. PS #2: Room Identification Sign with Braille and Two Changeable Message Insert.
    a. Sign Size: 6"x6"x ¼".
    b. Message Panel Material: Interior Panel Sign, Series 300 w/two changeable message inserts.

c. Text/Message: Room #.
d. Location: As directed in the field by Architect.
e. Quantity: Provide one for Office, Classroom.

3. PS #3: Room Identification Sign with pictograms and Braille.

a. Sign Size: 6”x8”x ¼”.
b. Message Panel Material: Interior Panel Sign, Series 300 w/male or female pictogram and accessibility symbol.
c. Text/Message: Male or Female.
d. Location: As directed in the field by Architect.
e. Quantity: one per toilet room, gender as indicated by room name.

4. PS #5: Room Identification Sign with Braille- Exterior:

a. Sign Size: 6”x6”x ¼”.
b. Message Panel Material: Exterior Panel Sign, Series 300.
c. Text/Message: Room #.
d. Location: As directed in the field by Architect.
e. Quantity: Provide one at each exterior mechanical or electrical room exterior door.

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. 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. Apperance 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 three 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. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. 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. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
5. 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.
6. 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.
7. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

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.

END OF SECTION 101400

SECTION 102113 - TOILET COMPARTMENTS

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-polymer toilet compartments configured as toilet enclosures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of reinforcements for compartment-mounted grab bars.
3. Show locations of centerlines of toilet fixtures.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

B. Stainless-Steel Castings: ASTM A 743/A 743M.

2.2 SOLID-POLYMER UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Accurate Partitions Corporation; ASI Group (Tough Texture TT).
2. Global Partition Systems; ASI Group (Tough Texture TT).
3. Scranton Products (Basis of Design, Hiny Hiders Santana-Comtec Grip EX Texture)

B. Toilet-Enclosure Style: Overhead braced.

C. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range. Provide color and surface texture pattern similar to Hiny Hiders Santana-Comtec “Stainless Steel Grip EX” Collection.

D. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

E. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 36-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two

fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102800 - TOILET, BATH, AND LAUNDRY 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. Public-use washroom accessories.
2. Underlavatory guards.
3. Custodial accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Project Acceptance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Toilet Tissue (Jumbo-Roll) Dispenser:

1. Description: Two-roll unit with sliding panel to expose other roll.
2. Mounting: Surface mounted.
3. Capacity: 9- or 10-inch- diameter rolls.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at front.

C. Combination Towel (Folded) Dispenser/Waste Receptacle:

1. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
2. Mounting: Semirecessed.
3. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
4. Minimum Waste-Receptacle Capacity: 18 GAL.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
6. Liner: Reusable, vinyl waste-receptacle liner.

D. Grab Bar:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

3. Outside Diameter: 1-1/2 inches.
4. Configuration and Length: As indicated on Drawings.

E. Mirror Unit:

1. Frame: Stainless-steel angle, 0.05 inch thick.

    a. Corners: Welded and ground smooth.

2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

3. Size: As indicated on Drawings.

2.3 UNDERLAVATORY GUARDS

A. Under lavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Mop and Broom Holder:

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Length: 36 inches.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
    b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.5 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

D. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - 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.

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.

1. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

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.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-End & Croker Corporation.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc
d. Larsens Manufacturing Company.

B. Cabinet Construction: Nonrated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Stainless-steel sheet.

1. Shelf: Same metal and finish as cabinet.

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 backbend depth.

E. Cabinet Trim Material: Stainless-steel sheet.

F. Door Material: Stainless-steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

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.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Silk-screened.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Materials:

1. Stainless Steel: ASTM A 666, Type 304.
2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

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. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. 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.

2.5 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

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

1. Fire-Protection Cabinets: 54 inches 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 104413

SECTION 104416 - 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.

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 and mounting brackets.

1.4 CLOSEOUT SUBMITTALS

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

1.5 COORDINATION

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

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Fire End & Croker Corporation
    b. J. L. Industries, Inc., a division of Activar Construction Products Group
    c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc
    d. Larsen's Manufacturing Company

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 3-A:40-B:C, 6-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION: 105300- ALUMINUM CANOPY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work in this section includes furnishing and installation of roll-formed aluminum cantilevered style canopies.

B. Related Items and Considerations

1. Flashing of various designs may be required. Generic flashing. Specialty flashing to be supplied by installer.

2. Determine wall construction, make-up and thickness.

3. Ensure adequate wall condition to carry canopy loads where required.

4. Consider water drainage away from canopy where necessary.

5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.2 FIELD MEASUREMENT

A. Confirm dimensions prior to preparation of shop drawings when possible.

B. If requested, supply manufacturer s standard literature and specifications for canopies.

C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly, signed and sealed by a North Carolina professional engineer.

1.3 PERFORMANCE REQUIREMENTS

A. Canopy must conform to local building codes.

1.4 DELIVER, STORAGE, HANDLING

A. Deliver and store all canopy components in protected areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Decking shall consist of an interlocking roll-form 2 1/2 W style pan (.040" aluminum).

B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown on Drawings.

C. Fascia shall be standard extruded 8" J style.

2.2 FINISHES

A. Finish type shall be -- Class II Clear Anodized.

2.3 FABRICATION

A. All canopies are shipped in preassembled sections for ease of installation.
   1. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
B. Decking shall be designed with interlocking roll-formed aluminum members.
C. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Front Scupper.

PART 3 - EXECUTION

3.1 INSPECTION

A. Confirm that surrounding area is ready for the canopy installation.
B. Installer shall confirm dimensions and elevations to be as shown on drawings.
C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.2 INSTALLATION

A. Installation shall be in strict accordance with manufacturer s shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.3 After installation, entire system shall be left in a clean condition.

END OF SECTION 105300

SECTION 123661 - SIMULATED STONE COUNTERTOPS

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-surface-material countertops and backsplashes.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size solid-surface-material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: 3/4-inch bullnose.

2. Backsplash: Radius edge with 3/8-inch radius.
3. Endsplash: Matching backsplash.

B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 3/4-inch- thick, solid surface material.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

2.2 COUNTERTOP MATERIALS

A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

B. Adhesives: Adhesives shall not contain urea formaldehyde.

C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Type: Provide Standard Type unless Special Purpose Type is indicated.
2. Colors and Patterns: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 123661

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Stripping and stockpiling topsoil.
2. Stripping and stockpiling rock.
3. Temporary erosion and sedimentation control.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

D. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 8 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.4 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade pavements.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete pavements.
6. Subbase course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.

1.3 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification Groups GW, GP, GM, GC, SM, SW and SP, or a combination of these groups having less than 20% by weight of fines, a liquid limit less than 20, and plastic limit less than 6; free of rubble, organics, clay, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups ML, MH, CL, CH, OL, SC, OH and PT or a combination of these groups. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Aggregate for Aggregate Base Course: Aggregate meeting the requirements of Section 520 of "Standard Specifications for Roads and Strucutres" as issued by NCDOT.

E. Drainage (Porous) Fill: A 4-inch layer of washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100% passing a 1-1/2" sieve and not more than 5% passing a No. 4 sieve.

F. Select Backfill: Job excavated or borrow material consisting of coarse sands, fine sands, with not more than 15% by weight passing the No. 200 sieve. This does not include clays, silts, organic soils or any materials not acceptable as fill material. Select backfill must receive prior approval from the Engineer before use.

G. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation for the parking lot, building, and area behind curb shall conform to the lines, grades, cross sections, and dimensions indicated on the drawings and shall include the excavation of all unsuitable materials from the subgrade. Subgrade shall conform to proposed line, grade and cross-section. This operation shall include any reshaping and wetting or drying required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Excavation is Unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

E. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

F. Subgrade Inspections: Notify Architect when excavations have reached required subgrade. If Architect's representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

G. The exposed subgrade soils in the extended building footprint shall be densified in place using a medium weight vibratory roller, except within 30 feet of the existing building where static rolling shall be utilized. The vibratory rolling shall extend a distance of 10 feet outside the perimeter of the building. The roller should make at least 6 passes across the site, with the second set of 3 passes perpendicular to the first set of 3 passes. If water is brought to the surface by the vibratory rolling, the operation shall be discontinued until the water subsides. Vibratory rolling should be completed during dry weather. After the vibratory rolling, pore pressures should be allowed to dissipate for a minimum of 16 hours. After the waiting period, proof rolling operations under the building shall be performed.

H. Proof-roll subgrade below the building slabs with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h). Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes). Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

I. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

J. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.2 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

B. Notify Architect when excavations have reached required depth.

C. If Architect's representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

D. The Architects representative shall use a combination of hand auger borings and dynamic cone penetrometer (DCP) testing to determine the suitability of the bearing materials for the design bearing pressure. DCP testing shall be performed to a depth of 3 to 5 feet below the bottom of footing excavations. Excessively soft, loose or wet bearing soils shall be overexcavated to a depth recommended by the architects' representative. Footings can bear directly on these soils at the lower level or the excavated soils could be replaced with compacted soil fill or washed, crushed stone (NCDOT No. 57) wrapped in a geotextile fabric (Mirafi 140 N or equivalent).

3.3 EXCAVATION FOR PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

B. When excavation has reached required subgrade elevations, provide a proof rolling of the prepared pavement subgrade with a heavy roller or loaded dump truck (+25 tons) in the presence of the Engineer's Representative. The proof rolling shall be covered by the wheels of the proof roller operating at a speed between 2-1/2 and 3-1/2 miles per hour.

C. Any areas that rut or pump excessively shall be scarified by the contractor and allowed to dry. If the areas continue to rut or pump they shall be undercut and backfilled with select material as directed by the Engineer.

D. After undercut and backfill operations are complete, a final proofrolling of the undercut areas will be performed in the presence of the Engineer's Representative.

E. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

F. Maintain sides and slopes of excavations in safe condition until completion of backfilling. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

G. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

H. Carry down shoring and bracing as excavation progresses.

3.4 DEWATERING: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

A. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and

B. foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other

C. dewatering system components necessary to convey water away from excavations.

D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to

E. convey rain water and water removed from excavations to collecting or run-off areas. Do not use

F. trench excavations as temporary drainage ditches.

3.5 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.6 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification as indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density at optimum moisture content as determined by ASTM D 698.

C. Structures, Building Slabs, Steps and Pavements: Compact top 12" of subgrade at 98% maximum density. Each layer of backfill or fill material below top 12" shall be compacted to 95% maximum density.

D. Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density.

E. Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 95% maximum density.

F. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

G. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

H. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.7 BACKFILL AND FILL

A. General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

B. In excavations, use satisfactory excavated or borrow material.

C. Under grassed areas, use satisfactory excavated or borrow material.

D. Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.

E. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Inspection, testing, approval, and recording locations of underground utilities.
   2. Removal of trash and debris.

F. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

G. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

H. Placement and Compaction: Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

I. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content.

J. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

K. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift..

3.8 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grade areas as shown on the Drawings to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
   1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.
   2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.05' above or below required subgrade elevation.
   3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.
   4. Patches in driveways and roadways shall be graded to depth required to match existing pavement or to provide minimum pavement specified.
   5. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification

3.9 PAVEMENT SUBBASE COURSE

A. General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

B. See other Division-2 sections for paving specifications.

C. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

D. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12" width of shoulder simultaneously with compacting and rolling of each layer of subbase course.

E. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross- section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

F. When a compacted subbase course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.11 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.12 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 313116 - 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 ACTION SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For termite control products, from manufacturer.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

1.5 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.

C. Source Limitations: Obtain termite control products from single source from single manufacturer.

1.6 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.

1.7 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 Acceptance.

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, provide one of the following:

a. BASF Corporation, Agricultural Products; Termidor.
b. Bayer Environmental Science; Premise 75.
c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, Prevail.
d. Syngenta; Demon TC, Prelude, Probuild TC.

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: Under ground-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.

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 313116

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt patching.
   2. Hot-mix asphalt paving.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of “Standard Specifications for Road and Structures” of NCDOT for asphalt paving work.

   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Aggregate for Aggregate Base Course: Aggregate meeting the requirements of Section 520-2 of "Standard Specifications for Roads and Structures" as issued by NCDOT.

2.2 ASPHALT MATERIALS

A. Asphalt Concrete Plant Mix Pavements: Materials meeting the requirements of Section 610-2 of "Standard Specifications for Road and Structures" as issued by NCDOT.

2.3 AUXILIARY MATERIALS

A. Tack Coat: Materials meeting the requirements of Section 605-2 of "Standard Specifications for Road and Structures" as issued by NCDOT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 GENERAL

A. Install the aggregate base course, bituminous concrete base course, bituminous surface course, bituminous concrete binder course and tack coat in accordance with the applicable provisions of "Standards Specifications for Roads and Structures" as issued by the North Carolina Department of Transportation, except as otherwise noted herein.

3.3 SUBGRADE

A. Shape surface of areas under base course to line, grade and cross-section shown on drawings, with finish surface not more than 1/2" above or below the required subgrade elevation.

B. Patches in driveways and roadways shall be graded to depth required to match existing pavement or to provide minimum pavement specified.

3.4 AGGREGATE BASE COURSE

A. Place base course material on prepared subgrade in layers of uniform thickness. Grade the base course evenly to thickness indicated on drawings and compact to 100%. AASHTO T 180.

B. Maintain a uniform surface on the base course until the placement of the bituminous surface course is complete.

C. Provide a proof rolling of the compacted aggregate base course with a heavy roller or loaded dump truck (+25 tons) in the presence of the Engineer's Representative. The proof rolling shall be covered by the wheels of the proof roller operating at a speed between 2- 1/2 and 3-1/2 miles per hour.

D. Any areas that rut or pump excessively shall be allowed to dry or shall be undercut and backfilled with select backfill or coarse aggregate base course as directed by the Engineer.

E. After undercut and backfill operations are complete, a final proof rolling of the undercut areas will be performed in the presence of the Engineer's Representative.

3.5 TACK COAT

A. Tack coat shall be applied to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. All application of tack coat shall be in conformance with Section 605 of the N.C. Highway Specifications for Roads and Structures dated January 1, 2002.

B. Tack coat shall be uniformly applied at a rate 0.02 to 0.05 gallons per square yard. No more tack coat material shall be applied than can be covered with base, binder, or surface course during the following day's operations. No base, binder or surface mixture shall be deposited thereon until the tack coat has sufficiently cured to properly receive paving.

C. All exposed surfaces, not intended to contact paving, shall be protected sufficiently to prevent tack coat from being tracked or splattered on said surfaces. After the tack coat has been applied, it shall be protected until it has cured for a sufficient length of time to prevent it from being picked up by traffic.

3.6 PLACING BITUMINUOS CONCRETE PAVEMENT

A. Place bituminous concrete pavement in as continuous an operation as possible. The Contractor shall spread the materials to uniform density and strike a smooth finish true to cross-section and free from inequalities. Spread mixture at minimum temperature of 225 degrees F. Place each course in the required amounts, so that when compacted, they will conform to the indicated grade, cross section, and thickness.

B. Asphalt shall be put down in two courses.

C. Provide joints between old and new pavements and between successive days' work for continuous bond between adjoining work. Clean contact surfaces and apply tack coat.

D. Rolling: Begin rolling when bituminous concrete mixture will bear roller weight without excessive displacement. Repair surface defects with hot bituminous concrete material as rolling progresses. Cut out and patch defective areas and roll to blend with adjacent satisfactory paving. Continue rolling until maximum density is attained and roller marks eliminated.

E. Protect paving from damage and vehicular traffic until bituminous concrete mixture has cooled and attained its maximum degree of hardness.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549. Course Aggregate Base Course: 1/2", plus or minus. Bituminous Concrete Course: 1/4", plus or minus.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes Concrete Paving Including the Following:

1. Curbs and gutters.
2. Walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

D. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

F. Zinc Repair Material: ASTM A 780/A 780M.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I.
2. Fly Ash: ASTM C 618, Class C.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Water: Potable and complying with ASTM C 94/C 94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

E. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

F. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4500 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 30 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.11 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Project Acceptance inspections.

END OF SECTION 321313

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes painted markings applied to asphalt pavement.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.

1. Color: Match exiting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

3.3 PROTECTING AND CLEANING

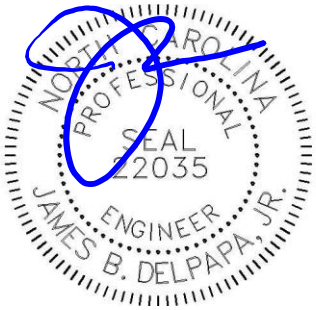
A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

PLUMBING SPECIFICATIONS

220500	GENERAL (PLUMBING) PROVISIONS
220523	VALVES
220529	PIPE HANGERS AND SUPPORTS
220700	PIPE INSULATION
221000	PIPE AND PIPE FITTINGS
221119	PIPING SPECIALTIES
223300	WATER HEATER
224000	PLUMBING FIXTURES
224500	EMERGENCY EYE WASH/SHOWER
229000	ELECTRICAL WORK IN PLUMBING CONTRACT



09/21/2026

SECTION 220500 – PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 Scope of Work

A. The Contractor shall provide all materials, equipment and labor necessary to install and set into operation a complete plumbing system as shown on the engineering drawings and as specified herein.

1.2 Quality Assurance

A. See the General and Supplementary General Conditions.

B. All work shall be in accordance with State Code and Underwriter's Regulations. Minimum requirements shall be the State Plumbing Code.

C. Wherever the words "Approved", "Approval", or "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.

D. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

E. All material and equipment that the Contractor proposes to substitute in lieu of those specified shall be submitted to the Engineer ten (10) days before the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified. Items that are submitted for approval after this date will not be accepted. Section 01600 of the General Conditions will be followed for substitutions after award of the contract.

1.3 Submittals

A. See General and Supplementary General Conditions.

B. Within twenty days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit to the Architect/Engineer for approval a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time. Six (6) sets of submittal data shall be provided for approval

C. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number, and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitutions for specified items. Acceptance for approval shall be in writing from the Engineer.

D. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent upon receipt of these as-built plans.

E. The Contractor shall furnish four (4) bound sets of maintenance and operating instructions as outlined in Paragraph C, (Execution), Item #6, of this specification section.

F. The Contractor shall submit to the Owner all certificates required for operating the system in compliance with the plans and specifications.

1.4 Product Delivery, Storage and Handling

A. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B. The Contractor shall protect all material and equipment from breakage, theft, or weather damage. No material or equipment shall be stored on the ground.

C. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

1.5 Work Conditions and Coordination

A. The Contractor shall review the electrical plans to establish points of connection and the extent of electrical work to be provided in his Contract. A licensed electrician shall perform all electrical work.

B. Electrical work shall be in accordance with State codes, and as specified in Division 16 contained herein.

C. Pipe chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

D. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be at the Contractor's expense at no extra cost to the Owner.

1.6 Guarantee

A. Where items of equipment or material carry a manufacturer’s warranty for any period in excess of twelve (12) months, then the manufacturer’s warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturers warranty period.

B. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the finals acceptance of the work an shall replace such defective materials or workmanship without cost to the owner.

C. Additionally, the contractor shall guarantee materials and workmanship against latent defects arising from faulty materials, faulty workmanship or negligence which is hidden or not readily apparent to the owner at the time of final acceptance and which is discovered by the owner within six (6) years following final acceptance of the work. The contractor shall replace such defective materials or workmanship without cost to the owner.

PART 2 - PRODUCT

2.1 Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Material and equipment found defective shall be removed and replaced at the Contractor's expense.

2.2 The Contractor shall provide nameplates for identification of all equipment, switches, panels, etc. The nameplates shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/4" minimum) etched into the white core. Nameplates shall be fastened with pan head tapping screws.

PART 3 - EXECUTION

3.1 Inspection

A. This Contractor shall examine the areas of completed work and shall insure that no defects or errors are present which would result in the poor application or installation of subsequent work.

3.2 Installation

A. All work shall be performed in a manner indicating proficiency in the trade.

B. All pipes shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

C. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

D. All finishing shall be by the General Contractor.

E. The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish all sleeves to the General Contractor for openings through poured masonry floors or walls, above grade, required for passage of all pipes required to support his equipment.

F. All fixtures shall be accurately roughed in according to the manufacturer's installation dimensions so that no offset adaptors, flexible connections or other improvising are necessary. All incorrect work shall be torn out and corrected and walls and floors patched.

G. Connections to cold water, soil and waste lines shall be made at locations shown on the Drawings.

3.3 Performance

A. The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

B. Rock excavation shall be defined in the Supplementary General Conditions. Unless specifically stated, neither rock excavation nor a unit price for rock excavation shall be required in the bid.

3.4 Erection

A. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

3.5 Adjust and Clean

A. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for intended service. In no event shall nameplates be painted.

C. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract.

3.6 Maintenance and Operating Manual

A. The Contractor shall prepare four (4) copies of a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:

1. Index and page numbers.
2. Certificate of substantial completion.
3. A summary sheet of warranties with the dates noted and a copy of all warranties.
4. List of all subcontractors and suppliers with names, addresses and phone numbers.
5. Certified testing and balancing report.
6. All submittal data and shop drawings.

B. The O & M manuals shall be installed in 3 ring heavy back note books with the name of the building and the words, “Operations and Maintenance Manuals” permanently affixed to the cover and spine.

C. The operating and maintenance manuals shall be submitted to the Engineer (2) weeks before the pre-final inspection, for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

END OF SECTION 220000

SECTION 220523 - VALVES

PART 1 - GENERAL

1.1 Valves shall be installed where indicated or required.

1.2 Insofar as possible, all valves shall be by the same manufacturer.

1.3 All valves stored on project site shall have ports closed.

1.4 Valves shall serve dual functions as shut-off and balancing valves.

1.5 Valves shall have an adjustable set point with locking mechanism which will permit closing of the valve and reopening of the valve to the previously determined set point.

PART 2 - PRODUCT

2.1 Isolation/Shutoff valves up to and including 3” in line size shall be full port, forged brass ball valves with threaded ends, Watts Series FBV-1 or approved equivalent.

2.2 Isolation/Shutoff valves 4” and larger shall be full port, 125# class, epoxy coated cast iron, flanged ball valves suitable for potable water service, FDA approved, Watts Series G-4000-FDA or approved equivalent

2.3 Provide stem extensions, as necessary, to accommodate piping insulation.

PART 3 - EXECUTION

3.1 All flanged connections shall be gasketed.

3.2 In no case shall raised face flanges be bolted to flat face flanges.

3.3 All valve stems shall be accessible and in no case shall valve stems be installed below horizontal.

3.4 The Contractor shall set in service all valves to operating conditions as part of his Contract.

3.5 The contractor shall provide 1” diameter brass valve tags for all valves.

3.6 The contractor shall provide ceiling markers for ceilings above lay-in ceiling.

3.7 The contractor shall provide a framed valve chart.

END OF SECTION 220523

SECTION 220529 - PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 This Section includes all hangers and supports, etc. as may be required to provide a complete piping system.

1.2 The actual arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainage, etc. shall be maintained.

1.3 Refer to specification Section 221000 for piping.

PART 2 - PRODUCT

2.1 Piping shall be as stated in Piping Section(s).

2.2 Hangers and supports shall be as manufactured by B-Line Systems, Inc., PHD Manufacturing, Empire, or Modern Support Devices.

PART 3 - EXECUTION

3.1 In no case shall this Contractor be allowed to cut or reduce the specified covering to allow the application of a smaller hanger than required.

3.2 Hangers shall be spaced as dictated by North Carolina Plumbing Code.

3.3 Hangers shall be provided at each change in direction.

3.4 Vertical risers shall be supported at each floor, 5 feet on center, and/or at changes in direction of pipe.

3.5 Do not support piping from bar joist bridging and/or roof deck.

END OF SECTION 220529

SECTION 220700 - PIPE INSULATION

PART 1 - GENERAL

1.1 Contractor shall insulate hot water supply and return, and cold water piping as specified below.

1.2 All insulation, linings, coverings and adhesives shall have a flame spread classification of 25 or less and a smoke developed rating of not more than 50, except for exposed outside piping.

PART 2 - PRODUCT

2.1 All hot and cold water piping (unless otherwise noted) shall be insulated with 1" thick fibrous glass materials with factory applied cover. All hot and cold water piping located in unconditioned spaces shall be insulated with 1 1/2" thick fibrous glass materials with factory applied cover. Cover shall be embossed vapor barrier, laminated with pressure sealing cap adhesive.

2.2 Closed cell insulation, of equal R-value may be used in lieu of fiberglass where concealed in walls. Insulation joints are to be sealed per manufacturer's recommendations. Taped joints will not be accepted. Insulation shall be finished with a fire retardant coating to attain proper fire rating.

2.3 All exposed piping in finished areas and equipment spaces shall have an additional layer of Kraft paper with vapor sealing tape followed by 8oz. /sq.yd. canvas cloth wrap, glued with two coats of sizing. Canvas shall be coated twice with Foster fireproof lagging to assure flame and smoke spread ratings.

PART 3 - EXECUTION

3.1 Insulation shall be installed in accordance with manufacturer's recommendations.

3.2 All exterior piping insulation above grade shall be provided with a protective aluminum jacket with a factory-applied asphalt and Kraft paper moisture barrier. Aluminum jackets shall be cross-cirmped (longitudinally corrugated) for strength. Aluminum jackets shall be not less than 0.106" thick and shall be secured with aluminum or stainless steel screw; not more than 8" apart.

3.3 All piping exposed outdoors shall be wrapped with electric trace before insulation is applied.

3.4 Any pipe covered prior to leak testing shall be exposed at contractor expense.

3.5 All piping shall be provided with identification in accordance with ANDI A13.1-1981 standards. Markers shall be located at each wall, floor, and ceiling penetration, and at every 25ft (10 feet in mechanical rooms). Markers shall be fully legible from floor level showing medium contained in pipe, and direction of flow. Wording on markers shall be as follows:

A. "Domestic Cold Water Supply".

B. "Domestic Hot Water Supply".

3.6 Provide sheet metal saddle at each hanger. Provide wood blocking at each saddle.

END OF SECTION 220700

SECTION 221000 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 This section includes all pipe, pipe fittings, hangers, and supports, etc. as may be required to provide a complete water plumbing system.

1.2 The actual arrangement of the piping shall follow the general locations shown on the drawings, such that clearances, line drainage, etc. shall be maintained.

1.3 Refer to specification Section 220523.

1.4 Refer to specification Section 221119.

1.5 Refer to specification Section 220529.

1.6 Refer to specification Section 220700.

PART 2 - PRODUCT

2.1 Domestic Water Pipe and Pipe Fittings

A. Copper Pipe

1. Water piping above grade shall be Type “L” hard drawn copper. Water piping below grade shall be Type “K” soft drawn. Pipe shall conform to ASTM B-88 Specification.
2. Water piping fittings shall be sweat or grooved type wrought copper conforming the ANSI-B16.22, ASME B16.18, or ASTM B584 Specification.
3. Use silver solder on all piping.
4. All piping systems shall be hydrostatically tested at 150 psi for a period of 48 hours without loss of pressure. Any leaks that occur shall be repaired and another test started.

2.2 Storm, Sanitary Waste and Vent Pipe and Pipe Fittings

A. PVC Pipe

1. Building sanitary sewer and storm lines below grade shall be schedule 40 PVC-DWV conforming to ASTM D-2665-68.
2. Building sanitary sewer, storm, and vent lines above grade shall be schedule 40 PVC-DWV conforming to ASTM D-2665-68.
3. PVC fittings to conform to piping specifications.
4. Joints for PVC piping shall be made using the piping manufacturer’s approved solvent cement.
5. Waste pipe shall be tested at each floor. A test tee will be installed below each floor and pipe will be filled with water for a height of 10’ above finished floor. The pipe shall be

gas and water tight. Water shall stand in the system for a period of 3 hours without evidence of leakage.

6. PVC piping is not permitted in return air plenums.

PART 3 - EXECUTION

3.1 Sleeves shall be provided wherever pipes pass through walls, floors, and ceilings. Sleeves shall be Schedule 40, black steel, ½" in diameter larger than the pipe or insulation on the pipe. Sleeves through floors shall be caulked and made watertight.

3.2 In pipe chases, the Contractor shall provide for suspension of all piping from the structure. Do not allow piping to rub against masonry when expanding and contracting.

3.3 Close and protect open ends of piping until final connections are made. Such closing shall be made with fittings which cannot be easily removed. Caps or plugs shall be required at all times during construction so that no pipes are left open at the end of any day's work, even though continuation is expected the next day.

3.4 All piping and equipment installed under this Contract shall be tested in the presence of the Engineer or a designated representative of the Owner, and the proper Plumbing Inspector, proved tight for the periods stated above, or longer if required by the Inspector. Engineer shall be given 48 hour written notification of all tests.

3.5 No plumbing system or part thereof shall be covered or concealed until after it has been tested and approved. If such work has been covered or concealed before testing, it shall be exposed for testing.

3.6 All water piping shall be sterilized with chlorine, 50 milligrams per liter, and held for a 24-hour period, after which the system shall be flushed prior to being put into service. During the flushing of the system, all flush valves shall be thoroughly flushed out to insure the removal of sediment, pipe dope, etc., from water lines and flush valves, removing such working parts of the flush valves as may be deemed necessary. The system shall be drained and flushed sufficiently to provide chlorine residue of 0.2 ppm or less. Provide documentation of test results of domestic water from qualified testing laboratory at final inspection.

END OF SECTION 221000

SECTION 221119 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 This Section includes miscellaneous items required for a complete plumbing system.

PART 2 - PRODUCT

2.1 Escutcheons shall be chrome plated, spring type, on all pipes passing through walls and ceilings in finished areas. Floor escutcheons shall be cast brass, chrome plated, with set screw.

2.2 Stops shall be compression type, chrome plated, angle or straight way pattern on all fixtures, hot and cold water supply. On service sinks, use brass gate valve as specified.

2.3 Flashing for vents through the roof shall be two-piece type, 16 ounce copper counter flashing and base flashing, or a two-piece type, 4 pound lead counter flashing and base flashing. The base flashing shall be installed by the General Contractor with the roof system.

2.4 Pipe anchors for rough-in use shall be "Rapid Rough" products. Use for anchoring rough-in of all hot and cold water connections for all lavatories, sinks and other wall connected fixtures.

2.5 Insulating couplings shall be V-line, as manufactured by Walter Vallett or approved equal.

2.6 Shock absorbers shall be of all stainless steel construction and in conformance with P. D. I. Standard WH201. Shock absorbers shall be installed as noted at the locations shown on the plans and shall be totally accessible. Where there are no shock absorbers noted or shown on the plans, 18 inch air chamber type shock absorbers shall be installed at the hot and cold water supply to each fixture.

2.7 Unions shall be bronze body with packless brass ground joints. Wrought iron pipe unions shall be malleable iron, ground joint with bronze to iron seat.

PART 3 - EXECUTION

3.1 Escutcheons shall be of sufficient size to cover outside diameter of the pipe or the insulation of the pipe.

3.2 Vent flashing shall extend down at least 4 inches from the top of the pipe. Flashing shall extend at least 12 inches in all directions from the pipe and shall be parallel to the roof line.

3.3 Pipe anchors for rough-in use shall be installed to hold pipes securely in alignment, according to the manufacturer's rough-in dimensions. Remove these devices after the wall is built around the pipes.

3.4 Unions shall be installed as shown on the plans, and where required, to disconnect piping for future replacement or repairs.

3.5 Dielectric unions shall be installed at hot water heaters and at any junction of dissimilar metal pipes.

END OF SECTION 221119

SECTION 223300 - WATER HEATER

PART 1 - GENERAL

1.1 Provide water heater as scheduled on the drawings.

1.2 All water heaters shall be by one manufacturer insofar as possible.

1.3 Water heaters shall be State Industries, AO Smith, or approved equivalent.

PART 2 - PRODUCT

2.1 Water heaters shall be UL listed.

2.2 Water heaters shall meet the standby loss requirements of the U.S. Department of energy and current edition of ASHRAE/IESNA 90.1.

2.3 Water heaters shall have 150 psi working pressure and be equipped with extruded high density anode rod.

2.4 All internal surfaces of the heater(s) exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 1400°F to 1600°F.

2.5 Electric heating elements shall be medium watt density with zinc plated copper sheath. Each element shall be controlled by an individually mounted thermostat and high temperature cutoff switch.

2.6 The outer jacket shall be of backed enamel finish and shall enclose the tank with foam insulation.

PART 3 - EXECUTION

3.1 Water heaters shall be installed as shown on the drawings.

3.2 Water heaters shall be provided with accessories noted on the drawings.

END OF SECTION 223300

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 Provide plumbing fixtures as scheduled on the drawings.

1.2 All fixtures shall be by one manufacturer insofar as possible.

1.3 Submit shop drawings on the following:

A. Fixtures

B. Floor drains and cleanouts

C. Trim

1.4 All fixtures are to be white.

PART 2 - PRODUCT

2.1 Products approved for use on this shall be as follows:

A. Fixtures: Kohler, American Standard, Eljer, Zurn, Toto, Crane

B. Stainless steel sinks: Elkay, Just

C. Flush Valves: Sloan, Delaney, Zurn

D. Floor drains and cleanouts: Zurn, Smith, and Josam.

E. Trim: Kohler, American Standard, Eljer, Chicago Faucets, T & S Brass and Bronze, Delta, Symmons, Sloan, Delaney, Stern-Williams, McGuire, Brasscraft, Cambridge Brass, Speakman, Zurn, Moen.

PART 3 - EXECUTION

3.1 Fixtures and carriers shall be installed in accordance with the manufacturer's recommendations.

3.2 All fixtures, drains, traps, etc. shall be set plumb and level.

3.3 All handicapped fixtures and trim shall be installed in accordance with the State Building Code, latest edition.

3.4 Provide trap primer and required piping on all floor drains.

3.5 All fixtures are to be water saving type.

3.6 Provide vandal-proof options for all fixtures used by public. This includes screws, aerators, and showerheads.

END OF SECTION 224000

SECTION 224500 - EMERGENCY EYE WASH/SHOWER

PART 1 - GENERAL

1.1 Provide emergency eye wash/shower as scheduled on the drawings.

1.2 Emergency eye wash/shower shall be Bradley Speakman, or approved equivalent.

PART 2 - PRODUCT

2.1 eye wash/shower shall meet the requirements of ANSI/ISEA Z358.1.

2.2 Emergency eye wash/shower shall be accessible, pedestal-mounted, self-draining, with separate supply and waste piping. Provide factory-assembled and tested units with standard-compliant identification sign and inspection tag.

2.3 Provide with thermostatic mixing valve.

PART 3 - EXECUTION

3.1 Emergency eye wash/shower shall be installed as shown on the drawings.

3.2 Emergency eye wash/shower shall be provided with accessories noted on the drawings.

3.3 Install fixture supports attached to building structure for fixtures requiring supports.

3.4 Install fixtures onto waste-fitting seals or flanges and attach to supports or building structure.

3.5 Install level, plumb, and firmly in place in accordance with manufacturer’s rough-in drawings.

3.6 Install water supply piping to each fixture requiring water supply connection. Provide stop on each supply in readily-serviced location. Fasten supply piping to supports or substrate.

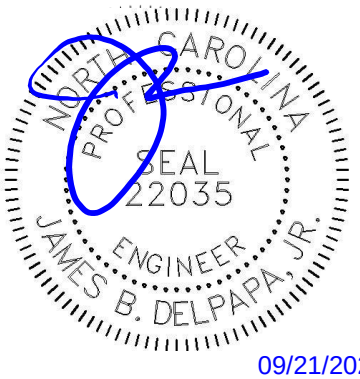
3.7 Install trap and waste piping to each fixture requiring sanitary system connection.

3.8 Install escutcheons at exposed piping penetrations in finished locations.

END OF SECTION 224500

MECHANICAL SPECIFICATIONS

230000	MECHANICAL GENERAL PROVISIONS
230513	ELECTRICAL WORK (MECHANICAL)
230529	MECHANICAL HANGERS AND SUPPORTS
230593	TESTING AND BALANCING
230700	INSULATION
230900	BUILDING AUTOMATION SYSTEM REQUIREMENTS
232000	PIPE
233000	DUCTWORK
233400	FANS
233700	AIR DISTRIBUTION
238143	SPLIT SYSTEM HEAT PUMPS



09/21/2026

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all materials, equipment and labor necessary to install and set into operation a complete mechanical systems as shown on the engineering drawings and as specified herein.

1.2 Quality Assurance

A. See the General and Supplementary General Conditions.

B. All work shall be in accordance with State Code and Underwriter's Regulations. Minimum requirements shall be the State Plumbing, Mechanical, Gas, and Energy Code.

C. Wherever the words "Approved", "Approval", or "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.

D. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

E. All material and equipment that the Contractor proposes to substitute in lieu of those specified, shall be submitted to the Engineer ten (10) days before the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified. Items that are submitted for approval after this date will not be accepted. The General Conditions will be followed for substitutions after award of the contract.

1.3 Submittals

A. See General and Supplementary General Conditions.

B. Within twenty days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit to the Architect/Engineer for approval a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time. Six (6) sets of submittal data shall be provided for approval

C. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number, and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitutions for specified items. Acceptance for approval shall be in writing from the Engineer.

D. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent upon receipt of these as-built plans.

E. The Contractor shall furnish four (4) bound sets of maintenance and operating instructions as outlined in Paragraph C, (Execution), Item #6, of this specification section.

F. The Contractor shall submit to the Owner all certificates required for operating the system in compliance with the plans and specifications.

1.4 Product Delivery, Storage and Handling

A. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B. The Contractor shall protect all material and equipment from breakage, theft, or weather damage. No material or equipment shall be stored on the ground.

C. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

1.5 Work Conditions and Coordination

A. The Contractor shall review the electrical plans to establish points of connection and the extent of electrical work to be provided in his Contract. All electrical work shall be performed by a licensed electrician.

B. Electrical work shall be in accordance with State codes, and as specified in Division 26 contained herein.

C. Pipe chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

D. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be at the Contractor's expense at no extra cost to the Owner.

1.6 Guarantee

A. Where items of equipment or material carry a manufacturer’s warranty for any period in excess of twelve (12) months, then the manufacturer’s warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturers warranty period.

B. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the finals acceptance of the work an shall replace such defective materials or workmanship without cost to the owner.

C. The contractor shall provide a five year compressor warranty for all refrigeration compressors from date of system acceptance.

D. Additionally, the contractor shall guarantee materials and workmanship against latent defects arising from faulty materials, faulty workmanship or negligence which is hidden or not readily apparent to the owner at the time of final acceptance and which is discovered by the owner within six (6) years following final acceptance of the work. The contractor shall replace such defective materials or workmanship without cost to the owner.

PART 2 - PRODUCT

2.1 Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Material and equipment found defective shall be removed and replaced at the Contractor's expense.

2.2 The Contractor shall provide nameplates for identification of all equipment, switches, panels, etc. The nameplates shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/4" minimum) etched into the white core. Nameplates shall be fastened with pan head tapping screws.

PART 3 - EXECUTION

3.1 Inspection

A. This Contractor shall examine the areas of completed work and shall insure that no defects or errors are present which would result in the poor application or installation of subsequent work.

3.2 Installation

A. All work shall be performed in a manner indicating proficiency in the trade.

B. All pipes shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

C. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

D. All finishing shall be by the General Contractor.

E. The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish all sleeves to the General Contractor for openings through poured masonry floors or walls, above grade, required for passage of all pipes required to support his equipment.

F. All fixtures shall be accurately roughed in according to the manufacturer's installation dimensions so that no offset adaptors, flexible connections or other improvising are necessary. All incorrect work shall be torn out and corrected and walls and floors patched.

3.3 Performance

A. The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

B. Rock excavation shall be defined in the Supplementary General Conditions. Unless specifically stated, neither rock excavation nor a unit price for rock excavation shall be required in the bid.

3.4 Erection

A. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

3.5 Adjust and Clean

A. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for intended service. In no event shall nameplates be painted.

C. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract.

3.6 Maintenance and Operating Manual

A. The Contractor shall prepare four (4) copies of a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:

1. Index and page numbers.
2. Certificate of substantial completion.
3. A summary sheet of warranties with the dates noted and a copy of all warranties.
4. List of all subcontractors and suppliers with names, addresses and phone numbers.
5. Certified testing and balancing report.
6. All submittal data and shop drawings.

B. The O & M manuals shall be installed in 3 ring heavy back note books with the name of the building and the words, “Operations and Maintenance Manuals” permanently affixed to the cover and spine.

C. The operating and maintenance manuals shall be submitted to the Engineer (2) weeks before the pre-final inspection, for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

D. An electronic copy of the O&M Manual shall be provide on disk or thumb drive.

3.7 Owner Training

A. After substantial completion and prior to final acceptance of the project the owner training shall be conducted. The training shall be conducted in a classroom setting with the contractor providing all the necessary personnel, literature, software to walk the owner through all the systems and components used in the project. A separate session shall be conducted for building controls and their proper operation. At the conclusion of each session the owner shall be fully capable of proper operation and maintenance of all systems and their components. All sessions shall be videoed for future reference. Video shall be shared with the owner either on thumb drive or USB device.

END OF SECTION 23 00 00

PART 1 - GENERAL

1.1 This Contractor shall be responsible for the entire control system and control connections to all equipment installed as part of his contract.

1.2 Wiring from disconnect switches, junction boxes, etc. up to mechanical equipment shall be by this contractor. Final electrical connections to mechanical equipment shall be by this contractor.

1.3 All power and control wiring shall be in conduits.

1.4 All electrical work shall be performed by a licensed electrician.

1.5 All electrical work shall be in accordance with the State Building Code and all its supplements and the latest edition of the National Electrical Code.

PART 2 - PRODUCT

2.1 All motor starters, disconnects, switches, relays, conduits, conductors, etc. that are required for a complete electrical power and/or control system shall conform to the requirements set forth by NEC.

2.2 Refer to the plans for the type, size and electrical characteristics of the starters, disconnects, switches, relays, conductor and conduits.

2.3 All conductors and conduits shall be sized as noted on the plans or as required per NEC.

PART 3 - EXECUTION

3.1 All motor starters, disconnects, and switches shall be installed on or as close to the equipment they are serving as possible, or where shown on the plans.

3.2 Electrical connection to equipment subject to vibration which develops objectionable noises shall be made from the conduit system with short lengths of flexible "Liquid- Tite" conduit. Connection to other equipment shall be made with rigid conduit.

3.3 Conduits shall be run in a concealed space such as wall cavities, ceiling cavities, etc. except in the mechanical rooms where conduit may be run exposed.

END OF SECTION 230513

PART 1 - GENERAL

1.1 This Section includes all hangers and supports, etc. as may be required to provide a complete piping system.

1.2 The actual arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainage, etc. shall be maintained.

1.3 Refer to specification Section 232000 for piping.

PART 2 - PRODUCT

2.1 Piping shall be as stated in Piping Section(s).

2.2 Hangers and supports shall be as manufactured by B-Line Systems, Inc., PHD Manufacturing, Empire, or Modern Support Devices.

PART 3 - EXECUTION

3.1 In no case shall this Contractor be allowed to cut or reduce the specified covering to allow the application of a smaller hanger than required.

3.2 Hangers shall be spaced as dictated by North Carolina Plumbing Code.

3.3 Hangers shall be provided at each change in direction.

3.4 Vertical risers shall be supported at each floor, 5 feet on center, and/or at changes in direction of pipe.

3.5 Do not support piping from bar joist bridging and/or roof deck.

END OF SECTION 230529

SECTION 230593 – TESTING AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, Adjusting, and Balancing:

1. Air condition equipment, including air distribution devices, supply ducts, air handling units, condensing units, fans, coils, and related equipment.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE)

1. Standard 111-2008 – Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-conditioning and Refrigeration Systems.
2. Applications Handbook 2019, Chapter 39 – Testing, Adjusting, and Balancing

B. Testing, Adjusting and Balancing Bureau (TABB) – International Standards for Environmental Systems Balance.

C. Sheet Metal and Air Conditioning Contractors' National Standards for Total System Balance.

D. Associated Air Balance Council (AABC) – National Standards for Total System Balance.

E. National Environmental Balancing Bureau (NEBB) – Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

1.3 DEFINITIONS

A. Adjusting: Varying of system flow by modifying settings of dampers and valves, in combination with varying fan speeds to obtain optimum operating conditions for the entire system.

B. Balancing: Proportioning of air flows through system mains, branches and terminal devices using standardized procedures to obtain specified air flow while imposing the least amount of restriction on the HVAC system.

C. Testing: Use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristic, air flow in velocities or quantities used in evaluating the performance of an HVAC system.

1.4 COORDINATION

A. The testing, adjusting and balancing Contractor shall coordinate his work with the mechanical system and temperature control system installing Contractors to accomplish coordination and verification of system operation and readiness for testing, adjusting and balancing.

1.5 SUBMITTALS

A. Qualification Statements:

1. Submit company's certification documents, including:
2. Contractor Certification:

    a. Supervisor Certification
    b. Technician Certification

3. Submit name of testing agency to Owner within thirty (30) days on Notice to Proceed.
4. Submit list of projects completed by testing agency of similar size, scope and equipment. Include name of Contractor and building Owner contacts.
5. Submit a certification letter stating that the TAB agency is an independent entity not owned in part or in whole by any subcontractor employed on the current project.

B. Reports:

1. Deficiency Report: Following examination of installed system, prior to balancing, submit report indicating system deficiencies that would prevent proper testing, adjusting and balancing of systems and equipment to meet specified performance.
2. TAB Report: Submit a copy of the complete testing, adjusting and balancing report to FMC Project Manager and RECS Atlanta Staff Engineer via email when it becomes available. Report shall include any drawings indicating air outlets, thermostats and equipment identified to correspond with data sheets.

    a. Reports shall be on TABB/SMACNA (NEBB or AABC), forms that indicate information addressing each of the testing methods, readings and adjustments.

C. Closeout Submittals:

1. Provide complete copy of testing, adjusting and balancing report. Include report in operation and maintenance manual.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Testing and balancing shall be performed by a testing agency who specializes in testing, adjusting and balancing of heating, ventilating, air-moving equipment, air-conditioning systems, and has a minimum of one (1) year experience.
2. Testing agency shall have successfully completed a minimum of five (5) projects, similar in size and scope.
3. Testing agency shall be a certified member of TABB (AABC and/or NEBB).
4. Maintain a copy of applicable standards at the project site.

B. Certifications:

1. TAB Technician shall be certified by a nationally recognized certifying agency (AABC and/or NEBB).

C. Perform total system balance in accordance with Testing, Adjusting and Balancing Bureau (TABB) – Quality Assurance Program for Environmental Systems Balance, and (AABC National Standards for Field Measurement and Instrumentation and/or NEBB Quality Assurance Program – Conformance Certification).

1.7 PROJECT CONDITIONS

A. Testing, adjusting and balancing shall commence after the HVAC systems installation is complete and in working order. Associated areas of general construction shall be in place including interior and exterior doors, windows, walls, ceilings and existing conditions.

1.8 SPECIAL WARRANTY

A. Provide warranty for period of ninety (90) days following physical occupancy of building, during which time the Owner may request a re-check of up to 10% of total number of terminals, or resetting of any outlet, coil or device listed in the test report. This period of time shall be no longer than 180 days after submission of the completed report.

B. Warranty shall meet the requirements of the following program(s):

1. TABB – Quality Assurance Program
2. AABC – National Performance Guarantee
3. NEBB – Conformance Certification

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

2.1 Prior to commencing testing, adjusting and balancing of environmental system(s), verify the following conditions; if deficiencies are evident, submit Deficiency Report to Engineer. Do not begin testing, adjusting and balancing of environmental system until deficiencies have been remedied.

A. Systems are started and operating in a safe and normal condition.

B. Temperature control systems are installed, complete, and operable.

C. Automatic and manual dampers are operable and fully open.

D. Thermal overload protection is in place for fans and other equipment.

E. Start up air filters are removed.

F. Final filters are clean and properly installed.

G. Duct and fan systems are clean.

H. Fans are rotating correctly.

I. Fire and volume dampers are in place and open.

J. Air coils fins are cleaned and combed.

K. Access doors are closed and duct end caps are in place.

L. Air outlets are installed and connected.

M. Leak testing on duct system has been performed in accordance with SMACNA Standards, or as specified.

2.2 SITE TOLERANCES

A. Air Handling Systems: Adjust to within plus 10 percent of outlet total plus allowable leakage rate.

B. Air Outlets and Inlets: Adjust to within plus or minus 10 percent of design for the space.

2.3 AIR SYSTEMS PROCEDURE

A. Adhere to the following procedure:

1. TABB – HVAC Testing, Adjusting and Balancing International Standards; with particular focus on the following chapters:

    a. Preliminary TAB procedures
    b. General air systems TAB procedures
    c. TABB procedures for specific (VAV, CAV, Multizone, Dual duct, etc.) air systems

2. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) HVAC Systems – Testing, Adjusting and Balancing.
3. NEBB – Procedural standards for TAB of environmental systems.
4. AABC – National standards for total systems balance.

B. Minimum air procedures should include the following:

1. Test and adjust fan RPM to design requirements.
2. Test and record motor full load nameplate rating and actual ampere draw.
3. Test and record system static pressures, fan suction and discharge.
4. Adjust all main supply and return air duct to within tolerances listed in this section of work.
5. Test and adjust each diffuser, grille and register. Reading and tests of diffusers, grilles and registers shall include design velocity (FPM) and adjusted velocity, design CFM and adjusted CFM.
6. Test and record outside, mixed air, and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
7. In coordination with the ATC contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
8. Test and adjust air handling and distribution systems to provide required or design supply, return, outside and exhaust air quantities within design tolerance.
9. In air systems employing filters, blank off filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

10. Make air velocity measurements in ducts by Pitot tube traverse entire cross-sectional area of duct in accordance with SMACNA equal area method or Log Linear method.
11. Measure air quantities at all air inlets and outlets.
12. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Vary total system air quantities by adjustments of fan speeds. Provide drive changes recommendations. Vary branch air quantities by damper regulation.
13. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for loading of filters and coils.
14. Adjust outside air automatic dampers. Outside air, return air and exhaust dampers for design conditions within specified tolerances.
15. Where modulating dampers or economizers are provided, take and record measurement at full return air, minimum outside air and 100 percent outside are mode of operation.

2.4 ADJUSTING

A. Recorded data shall represent actual measured or observed conditions.

B. Permanently mark setting of dampers and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

C. Leave systems in proper working, replacing belt guards, closing access doors, closing doors to electrical switch boxes and restoring thermostats to specified settings.

D. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

END OF SECTION 230593

PART 1 - GENERAL

1.1 This section includes insulation for piping, ductwork, and equipment, as shown on the plans.

1.2 All insulation, linings, coverings, and adhesives shall have a flame spread classification of 25 or less and a smoke developed rating of not more than 50.

1.3 Insulation shall be Knauf, Certainteed, Owens Corning, or Johns-Manville.

PART 2 - PRODUCT

2.1 Duct

A. Unless otherwise noted in the drawings all rectangular and round air conditioning supply, return, exhaust, and outside air duct shall be externally insulated with 2” thick, 3/4 lb. density foil scrim Kraft jacketed insulation. Joints shall be wrapped with a minimum of 3” wide FSK band of insulation to prevent any possible leakage and condensation. Ducts with widths over 30” shall be further secured on the underside with mechanical fasteners on 18” maximum centers.

B. In addition to the duct wrap specified in B1.a of this specification, all low pressure rectangular supply and return ductwork shall be lined for 15 feet downstream from air handling unit (or up to and including the first 90 degree elbow). Duct liner shall be 1” thick, 2lb. dense, Shuller Permorate Linacoustic HP, or approved equivalent. Coat all exposed leading edges and transverse joints with a fire retardant adhesive.

C. Duct sizes shown are actual duct dimension. Where ductwork is lined, as noted above, the duct insulation thickness shall be added to the listed ductwork dimensions for final duct size.

D. Duct routed outside the building shall be insulated with minimum R-8 fiberglass. All joints shall be sealed with mastic prior to insulating. Apply final skin of sheet metal and seal weather tight.

E. Duct board shall be 2” thickness rigid Fiberglas Owens/Corning or equal, ASTM C 612, 3 pounds per cubic foot density, with Foil reinforced jacket. The board shall be attached with field applied perforated base pins or weld pins applied on 12” centers. Finish shall be 8oz canvas jacket, totally sized with Foster 81-42W or equal lagging adhesive. Corner board shall be used on all edges.

2.2 Piping

A. All condensate drain piping, all refrigerant suction piping, and all refrigerant piping exposed on the exterior of the building shall be insulated with 1.5” wall tubular closed cell elastomeric insulation with all joints butted and cemented tight. Insulation shall be protected with aluminum jacket on all insulation exposed on exterior.

PART 3 - EXECUTION

3.1 Insulation shall be installed in accordance with manufacturer's recommendations.

3.2 All exterior piping insulation above grade shall be provided with a protective aluminum jacket with a factory-applied asphalt and kraft paper moisture barrier. Aluminum jackets shall be cross-crimped (longitudinally corrugated) for strength. Aluminum jackets shall be not less than 0.106" thick and shall be secured with aluminum or stainless steel screw; not more that 8" apart.

3.3 Any pipe covered prior to leak testing shall be exposed at contractor expense.

3.4 Exposed piping, hangers, saddles and supports in occupied areas shall be provided with primer coat for long term adhesion and shall be painted with minimum of 2 finish coats.

END OF SECTION 230700

SECTION 230900 – INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes the scope of work for the Facility Management and Control System that must be installed by a qualified FCMS Contractor and integrated to the Enterprise Server by the Enterprise Developer. This section also coordinates the responsibilities of the Mechanical and Electrical trade contractors pertaining to control products or systems, furnished by each trade, and that will be integrated by this Division.

B. All labor, material, equipment 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.

C. It is the owner's goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.2 SCOPE OF WORK

A. The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the owner's local or wide area network, depending on configuration. Each User shall configure a dashboard view of the pertinent data and this view shall be saved for later use. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through a standard Web browser, via the Internet and/or local area network. Each NAC shall communicate to LonMark/LonTalk (IDC), Bacnet (IBC), MODBUS and other open and legacy protocol systems/devices provided under this Division. In addition, from the controller(s) to the device(s) shall communicate to LonMark/LonTalk (IDC), Bacnet (IBC), MODBUS and other open and legacy protocol systems/devices provided under this Division. It is the owner's goal to eliminate any gateway or redundant device(s).

B. The Facility Management and Control System (FMCS) as provided in this Division shall be a JACE that provides an open automation infrastructure, an open license, and is available from multiple systems integrators. JACE shall have capability to integrate diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time over a secure network using a standard Web browser.

C. The work provided in this specification shall be performed by two entities. The FMCS Contractor shall have overall responsibility for the Division work. The Enterprise Developer shall be appointed by the Owner and shall provide all work at the Enterprise Server level. Owner will oversee and provide procurement for Enterprise Developer services. See Section 1.3 for more detail on the division of work.

D. All materials and equipment used shall be standard components. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

E. All wiring shall be done in accordance with all local and national codes.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Products integrated and installed but not furnished under this section

1. Project specific equipment

a. JACE-8000 w/ IO-34 and 4.10 software
b. Wall Adapter – power supply for J-2..90-240 VAC 50/60 Hz. Wall Adaptor
c. Web version of WorkPlace AX
d. 8 Universal Inputs – 4 Form A Relay Outputs and 4 0-10 VDC Analog Outputs
e. 16 Universal Inputs – 10 Form A Relay Outputs and 8 0-10 VDC Analog
f. Veris meter (if applicable)
g. Electric pulse meter (if applicable)
h. Gas meter (if applicable)
i. Water meter (if applicable)

1.4 QUALITY ASSURANCE

A. The FMCS system shall be designed and installed, commissioned and serviced by factory trained personnel. Systems Integrator shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

1. The Systems Integrator shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the FMCS.
2. The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of FMCS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of FMCS systems similar in size and complexity to this project with a maintained service organization. Provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. All FMCS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 91 6category PAZX; Standard UL 864, categories UDTZ, and QVAX and be so listed at the time of Bid.

D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

E. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

F. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.

1. Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1.5 SUBMITTALS

A. Provide individuals experienced with the installation and startup of equipment related to this type of integration.

1. Eight copies of shop drawings of the entire FMCS shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. The FMCS shall submit an architecture layout that depicts devices from the JACE to NAC down to the device level.
2. A complete written Sequence of Operation shall also be included with the submittal package. The FMCS Systems Integrator shall coordinate data from other contractors supplying products and systems, as part of their package and shall provide catalog data sheets, wiring diagrams and point lists to the owner for proper coordination of work.

B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol. The FMCS Systems Integrator shall be responsible for integrating all network level devices into the overall trunk cable schematic diagrams for the entire Wide Area Network (WAN).

C. Submittal shall also include a complete point list of all points to be connected FMCS by the Systems Integrator. System integrator shall provide necessary point lists, protocol documentation, and factory support information for systems provided in their respective divisions but integrated into the FMCS.

D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner. Submittal shall also include a copy of the expected Dashboard viewlets being provided for owner configuration. The owner will provide an example of an acceptable

graphic template. Where a particular graphic template does not exist, the Integrator shall create a similar template and gain approval during submittal process.

E. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Division 23 and 26 contractors shall provide as-builts for their portions of work. The FMCS Systems Integrator shall be responsible for as-builts pertaining to overall FMCS architecture and network diagrams. All as built drawings shall also be installed into the FMCS server in a dedicated directory.

1.6 SPECIFIC NOMENCLATURE

A. Acronyms used in this specification are as follows:

FMCS	Facility Management and Control System
TCS	Temperature Control System
NAC	Network Area Controller
IDC	Interoperable Digital Lon Controller
FPC	Freely Programmable Lon Controllers
GUI	Graphical User Interface
WBI	Web Browser Interface
POT	Portable Operator's Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement

1.7 SOFTWARE LICIENCE AGREEMENT

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

B. It is the owners express goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner.

1.8 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.9 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Systems Integrator's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.10 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire FMCS for a period of one year after beneficial use.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

C. With owner pre-approval, the on-line support services shall allow the local FMCS Systems Integrator to dial out over telephone lines to monitor and control the facility's building automation system. Pending owner approval, this remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

1. If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility.
2. If the problem cannot be resolved with on-line support services, the FMCS manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within a reasonable time frame.

1.11 ACCEPTABLE SYSTEM INTEGRATORS

A. The FMCS Systems Integrator shall provide NAC hardware, software and DDC components. NAC hardware and software shall be the Vykon brand. The successful FMCS Systems Integrator shall not have password access to the Enterprise Server and shall be restricted to NAC access.

B. The FMCS Systems Integrator shall have a technical support group accessible that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

C. Acceptable Systems Integrators of the hardware and software components as specified herein are as follows:

1. Open protocol systems

PART 2 - PRODUCTS

2.1 GENERAL

A. The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices and other devices as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, existing OPC if applicable, and other existing open and proprietary communication protocols if applicable in one open, interoperable system.

B. The supplied computer software shall employ component-based technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. 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.

2. 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.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and OBIX for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 100 Base-T, UTP-8 wire, category 5
3. Minimum throughput; 100 Mbps.

2.4 NETWORK ACCESS

A. Remote Access.

For Local Area Network installations the Owner shall provide a connection to the Internet to enable access via the customer's Intranet to a corporate server. FMCS Systems Integrator shall connect to IP drop provided by the Owner within 25 feet.

2.5 NETWORK AREA CONTROLLER (NAC)

A. The FMCS Systems Integrator shall supply one or more Network Area Controllers (NAC) as part of this contract to manage devices/points in all specification sections. This division shall be required to integrate BACNet zone information provided by the Division 280000 Systems Integrator into the HVAC and Lighting Sequence of Operation. The number of NACs provided by this Systems Integrator is dependent on the type/quantity of devices and points. It is the responsibility of the FMCS Systems Integrator to coordinate with all Division contractors to determine the quantity and type of NACs needed to fulfill the operating sequences.

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 LonWorks controller data and BACnet controller data
7. Network Management functions for all LonWorks based devices

C. The Network Area Controller must provide the following hardware features as a minimum:

1. Two Ethernet Ports – 10/100 Mbps
2. One LonWorks Interface Port – 78KB FTT-10A (if applicable)
3. Two RS-485 ports

4. 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)
5. The NAC must be capable of operation over a temperature range of 32 to 122°F
6. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
7. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

E. NAC 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.
7. Control equipment and network failures shall be treated as alarms and annunciated.
8. Alarms shall be annunciated in any of the following manners as defined by the user:
   a. Screen message text
   b. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
      1. Day of week
      2. Time of day
      3. Recipient
   c. Pagers via paging services that initiate a page on receipt of email message
   d. Graphic with flashing alarm object(s)
9. The following shall be recorded by the NAC for each alarm (at a minimum):

a. Time and date

b. Location (building, floor, zone, office number, etc.)

c. Equipment (air handler #, accessway, etc.)

d. Acknowledge time, date, and user who issued acknowledgement.

e. Number of occurrences since last acknowledgement.

10. Alarm actions may be initiated by user defined programmable objects created for that purpose.

11. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

12. 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.

13. Provide a "query" feature to allow review of specific alarms by user defined parameters.

14. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

15. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

F. NAC Data Collection and Storage

1. The NAC shall have the ability to collect data for any property of any object and store this data for future use. See points list for required logs.

2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

a. Designating the log as interval or deviation.

b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

c. 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.

d. 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.

e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

3. All log data shall be archived to a database in the Enterprise Server and the data shall be accessed from a standard Web browser and the Periscope Dashboard.

4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

5. All log data shall be available to the user in the following data formats:
    a. HTML
    b. XML
    c. Plain Text
    d. Comma or tab separated values
6. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
7. The NAC shall have the ability to archive its log data remotely to a server on the network. Provide the ability to configure the following archiving properties, at a minimum:
    a. Archive on time of day
    b. Archive on user-defined number of data stores in the log (buffer size)
    c. Archive when log has reached its user-defined capacity of data stores
    d. Provide ability to clear logs once archive.

G. NAC AUDIT LOG

1. 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 to a server. For each log entry, provide the following data:
    a. Time and date
    b. User ID
    c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

H. NAC DATABASE BACKUP AND STORAGE

1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Enterprise Developer shall coordinate with Owner to establish/implement a backup procedure.

2. 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.

3. 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.

2.6 WEB BROWSER CLIENTS

A. The system shall also allow use of an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. The system shall be capable of

providing a rich user experience (including full use of the engineering toolset) through the use of java applets or a simple user interface using only HTML, CSS and JavaScript. Refer to Sequence of Operations for the client side display types that are required on this project.

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 graphics, schedules, calendars, logs, etc 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:

1. 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.

2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client (unless clearly stated in the sequence of operation). Any animated graphical objects supported by the GUI shall be supported by the Web browser interface. Enterprise Developer shall provide a FMCS Systems Integrator with a basis of performance/expectation for GUI. FMCS Systems Integrator shall use this standard graphic template or modify the graphics slightly to achieve the desired specification requirement/outcome.

3. Storage of the graphical screens shall be in the Network Area Controller (NAC) and these graphics shall be “learned” by the Enterprise Server.

4. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

5. Owner 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.

        1. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

        2. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

    b. 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.

    c. View logs and charts

    d. View and acknowledge alarms

    e. Setup and execute SQL queries on log and archive information

6. The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide each specific user a defined home page based on

their usage requirements. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

7. 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.

2.7 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 components shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control components 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 components to the application components to provide "real-time" data updates. Any real-time data value or component property may be connected to display its current value on a user display. Systems requiring a separate software tool to create applications and browser user interface displays shall not be acceptable.

C. Programming Methods

1. Provide the capability to copy components from the supplied libraries, or from a user-defined library to the user's application. Components shall be linked by a graphical linking scheme by dragging a link from one component to another. Component links will support one-to-one, many-to-one, or one-to-many relationships. Linked components shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to components on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

2. Configuration of each component will be done through the component's property sheet using fill-in the blank fields, list boxes, and selection buttons. Requiring the use of custom programming, scripting language, or a manufacturer-specific procedural language for every component configuration will not be accepted.

3. 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.

4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database components shall not be allowed.

5. The system shall support component 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.

2.8 COMPONENT LIBRARIES

A. A standard library of components shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The components 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 components created in their application and store the new instances of these components 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 components and applications as they are developed.

D. All control components shall conform to the control component specified in the BACnet specification.

E. The component library shall include components 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 with the programming software:

1. 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 components 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.

2. For devices not conforming to the LonMark standard, provide a dynamic component 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.

3. For BACnet devices, provide the following components 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

4. For each BACnet component, provide the ability to assign the component a BACnet device and component instance number.

5. 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

2.9 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.

2.10 BACNet NETWORK MANAGEMENT

A. The Network Area Controller shall support the integration of device data from BACNet TCP/IP or BACNet MSTP system devices. The connection to the BACNet system shall be via an RS485, or Ethernet IP as required by the device.

B. Provide the required components in the library, included with the Graphical User Interface programming software, to support the integration of the Bacnet system data into the FMCS. Components provided shall include at a minimum:

1. Read/Write BACNet AI Points
2. Read/Write BACNet AO Points
3. Read/Write BACNet AV Points
4. Read/Write BACNet BI Points
5. Read/Write BACNet BO Points
6. Read/Write BACNet BV Points

C. All scheduling, alarming, logging and global supervisory control functions, of the BACNet system devices, shall be performed by the Network Area Controller.

D. The FMCS supplier shall provide a BACNet system communications driver. The equipment system vendor that provided the equipment utilizing BACNet shall provide documentation of the system’s interface and shall provide factory support at no charge during system commissioning

E. BACnet Conformance:

1. Logic controllers shall as a minimum support MS/TP BACnet LAN type. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Logic controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

   a. Files Functional Group
   b. Reinitialize Functional Group
   c. Device Communications Functional Group

2. Refer to Section 22.2, BACnet Functional Groups, in the BACnet Standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be

thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

2.11 COMMUNICATING THERMOSTATS

A. The manufacturer of the Thermostat hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.

B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.

C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

D. Acceptable providers of the Communicating Thermostat hardware and software components as specified herein are as follows. Acceptance as a product provider does not provide approval to be an acceptable FMCS Systems Integrator.

a. Reliable
b. ABB
c. Viconics
d. Distech Controls
e. Honeywell
f. Delta

E. Communicating Thermostats shall be LON or BACNet thermostats. FMCS Systems Integrator shall standardize on a single protocol for all thermostats and IDC/IBCs (if non thermostat controllers are needed) provided, i.e. all controllers provided shall be of the same protocol. This does not necessarily apply to controllers provided in other sections of the specification as there may be limited choices, but when possible, standardize on a single protocol.

2.12 LON DEVICES (IDC)

A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.

B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.

C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

D. Acceptable manufacturers of the hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable Systems Integrator.

a. Reliable
b. ABB
c. Viconics
d. Distech Controls
e. Honeywell
f. Delta

2.13 BACNET DEVICES (IBC)

A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.

B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.

C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

D. Acceptable manufacturers of the hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable Systems Integrator.

a. Reliable
b. ABB
c. Viconics
d. Distech Controls
e. Honeywell
f. Delta

2.14 LON/BACNET CONTROLLER(S) STANDARDS

A. Where possible provide LON Controllers or BACNet Controllers that can meet the required sequence of operation and can be configured rather that custom programmed. All controllers shall be designed for easy installation and servicing including removable enclosures, removable terminals, and factory applied labels for all I/O. All internal points shall be fully supported by the Graphical User Interface (GUI), allowing the user to easily modify them and monitor them. All of the internal programming points (e.g. variables, constants, PID's, timers, inputs and outputs) shall be exposed to the network on dedicated network variable outputs.

B. Performance Standards for Inputs - Provide software selectable universal inputs. Analog inputs - shall have the following minimum level of performance: 10 bit A to D resolution; manage thermistors with an accuracy of: ±0.9oF, and a Potentiometer. For VAV Applications provide a differential pressure input sensor built in to the controller with a adjustable range of .05" to 2" H20 (125-300PA) static pressure with a minimum accuracy of + or – 3%. Minimum response time shall be 0.5 seconds from input to output time.

C. Performance Standards for Outputs – Analog outputs shall have the following minimum level of performance: Tri-mode Voltage of 0-10 VDC (linear), digital 0-12 VDC (off/on) or PWM. All analog outputs shall be equipped with an auto-reset fuse. Output Resolution shall be a minimum 8 bits digital / analog converter. Digital outputs shall be provided with a minimum of a triac output rated at 24VAC and 1 amp. All analog outputs and power supply shall be fuse protected

D. Application Specific Controllers (ASC)- A controller designed through its I/O configuration and configurable control logic to be used for a specific type mechanical equipment. Typical applications are VAV boxes, Fan Coil Units, Roof Top Units, Unit Ventalators, Split DX Systems, Heat Pumps. Lighting Controls, etc. All ASC's shall conform to the LonMark or BACNet standards so long as such a standard exists for its intended application. The ASC shall allow the use of its spare I/O as dumb I/O to be shared over the network to NAC where a sequence of operation can be applied to the I/O. Such applications shall include but not be limited to exhaust fan control, heaters, light control, etc.

E. Freely Programmable Controllers (FPC) shall be a controller designed for more complex sequences of operations such as built up AHU's, central plant operations, electrical monitoring, and control and management for chillers, boilers and generators. These FPCs are to allow for the flexibility of custom control programming to meet the needed sequences of operation.

2.15 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 components in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FMCS. Components provided shall include at a minimum:

1. Read/Write Modbus AI Registers
2. Read/Write Modbus AO Registers
3. Read/Write Modbus BI Registers
4. 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

E. Provide a Modbus Interface to the following equipment:

1. switchgear
2. packaged pumping system
3. building energy metering

2.16 THIRD PARTY INTEGRATION

A. The Network Area Controller shall support the integration of device data from the existing control system. The connection to the existing system shall be via an RS-232 connection between the Network Area Controller and the existing control system {if applicable on this project}.

B. Provide the required data points from the third party integration per sequence of operations and/or points list

2.17 SENSORS

A. All control items, except thermostats, sensors and transmitters located in rooms shall be properly identified with engraved plastic nameplates permanently attached. Nameplates shall have white letters on a black background.

B. Room thermostat, sensor and transmitter locations shall be coordinated to align vertically or horizontally with adjacent light switches or other control devices. Room thermostats and sensors shall be mounted with the bottom 5’-0” above the floor. Sensors installed in areas where they are subject to physical abuse (ex: gymnasiums) shall be furnished with protective type aspirating guards. Sensors installed on exterior walls shall be installed on non-conductive (cork) sub-base. Sensors shall have plus or minus local control feature.

C. Temperature Sensors: Thermistor type with an accuracy of plus or minus 0.40 degree F over the entire control range. Sensors for pipe installations shall be immersion type, brass well, and thermistor with integral lead wire. Sensors for duct application shall be insertion probe type, stainless steel probe, integral handibox, and thermistor with integral lead wire. Space temperature sensors shall be compatible with the unit controller and shall be provided in a decorative metal or plastic enclosure (Nema 4X where exposed to pool environment). Space temperature sensors shall be provided with setpoint and temperature indication only. Outdoor temperature sensors shall be mounted inside a protective weather and sun shield and shall be located on a North wall.

D. Humidity Sensors: Thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%), 12 - 30 VDC input voltage, analog output (0 - 10 VDC). Operating range shall be 5 to 95% RH and -40 to 170 degree F. Duct mounted type sensors shall have a stainless steel insertion element, sealed to prohibit corrosion. Sensors shall be selected for wall, duct or outdoor type installation as appropriate.

E. Carbon Dioxide Sensors (CO2): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 50 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC/DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.

F. Differential Air Pressure Switch: Differential pressure switches for proving fan operation or sense dirty air filters shall be SPDT type, UL approved, and selected for the appropriate operating range of the equipment to which it is applied. Sensor shall have ¼" compression type fittings and shall have an adjustable setpoint. Furnish with ¼" barbed type static pressure tips.

G. Current Switches (Type 1): For proving fan or pump operational status, provide solid or split-core type current status switches with adjustable setpoint and solid-state internal circuitry. Current switch shall have induced power, trip point set adjustment to plus or minus 1% over a range of 1 to 135 amps, trip and power LED, and field adjustable to indicate both On-Off conditions and loss of load (broken belt, etc.). Units shall have a five-year manufacturer's warranty. Current switches shall be Hawkeye Series H-908 by Veris Industries, or approved equal.

H. Current Switches (Type 2): For proving fan or pump operational status, provide solid or split-core type current switches ("Go/No" type). Current switch shall have induced power, 100 percent solid state with no moving parts. Units shall have a five-year manufacturer's warranty. Current switches shall be Hawkeye series H-900 by Veris Industries, or approved equal.

I. Low Temperature Sensors: For sensing low temperatures in air handling units, provide SPST type switch, 35 to 45 degree F range, manual reset, vapor charged twenty foot long sensing element, and 120-volt electrical power connection. Low temperature sensor ("freeze-stat") shall be JCI Model A11A-1, or equal.

J. Pressure Transmitters: For sensing static pressure in a duct system (usually for VAV systems), provide a pressure transmitter with integral capacitance type sensing action, solid state circuitry, accuracy of plus or minus 1% of range, zero and span adjustments, 10 to 35 VDC operating voltage, 4 to 20mA output, and integral inlet port connections. Select pressure range suitable for the application. Differential pressure transmitter shall be Ashcroft CXLdp, or approved equal.

K. Line Voltage Thermostats: For control of equipment using line voltage on-off thermostats (exhaust fans, unit heaters, etc.) provide 120 volt UL Listed wall mounted thermostats. Thermostat shall have a range of 50 to 90 degree F with minimum 2 degree F differential, snap acting switch, and dial adjustment for temperature setting. Line Voltage Thermostats shall be Honeywell series T631 series or approved equal.

L. Firestat: For sensing sudden increases in duct temperature (ex: fire condition), provide 120 volt UL Listed SPST switch with adjustable setpoint that breaks the circuit on a rise in temperature above the setpoint and de-energizes the air handling unit fan.

M. Aquastat: For sensing temperature of a fluid within a pipe system, provide 120-volt SPST strap-on type aquastat, temperature control range of 100 to 240 degree F (adjustable). Aquastat shall be JCI Model A19DAC-1, or equal.

N. Air Flow Monitoring Device

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ebtron Advantage Gold Series for use with GTx116 transmitters or a comparable product by one of the following:

a. Tek-Air Systems
b. Johnson Controls

2. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
3. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.

    a. Each sensor assembly shall contain two individually wired, hermetically sealed bead-in-glass thermistors.
    b. Thermistors shall be mounted in the sensor assembly using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment.
    c. The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output.
    d. The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output.
    e. Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics.
    f. Devices using chip-in-glass or diode-case chip thermistors are not acceptable.
    g. Devices using less than two thermistors in each sensor assembly are not acceptable.
    h. Devices using platinum wire RTDs are not acceptable.
    i. Devices having electronic circuitry mounted in or at the sensor probe are not acceptable.
    j. Pitot tubes and arrays are not acceptable.
    k. Vortex shedding devices are not acceptable.

4. All Sensor Probes

    a. Each sensor assembly shall independently determine the airflow rate and temperature at each measurement point.
    b. Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST).
    c. Airflow accuracy shall be +/-2% of Reading over the entire operating airflow range.

        i. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.

    d. Temperature accuracy shall be +/-0.15° F over the entire operating temperature range of -20° F to 160° F.
    e. The operating humidity range for each sensor probe shall be 0-99% RH (non-condensing).

f. Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
g. Each sensor assembly shall not require matching to the transmitter in the field.
h. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter for each measurement location.

5. Duct and Probes

a. Probes shall be constructed of extruded, gold anodized, 6063 aluminum tube. All wires within the aluminum tube shall be Kynar coated.

b. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:

i. Insertion mounted through the side or top of the duct
ii. Internally mounted inside the duct or plenum
iii. Standoff mounted inside the plenum

c. The number of sensor housings provided for each location shall be as follows:

Duct Area (sq.ft.)	Total # Sensors / Location
<2	4
2 to < 4	6
4 to < 8	8
8 to <16	12
>=16	16

d. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.

6. Fan Inlet Probes

a. Sensor assemblies shall be mounted on 304 stainless steel housings.
b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
c. Mounting feet shall be constructed of 304 stainless steel.
d. The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.

7. Transmitters

a. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. The LCD display shall be capable of displaying individual airflow and temperature readings of each independent sensor assembly.
b. The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.

c. The transmitter shall have a power switch and operate on 24 VAC (isolation not required).

i. The transmitter shall use a switching power supply fused and protected from transients and power surges.

ii. The transmitter shall use “watch-dog” circuitry to assure reset after power disruption, transients and brown-outs.

d. All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.

e. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be installed at a location that is protected from weather and water.

f. The transmitter shall be capable of communicating with other devices using the following interface option: Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire)

9. The ATMD shall be UL listed as an entire assembly.

10. The ATMD shall carry the CE Mark for European Union shipments.

11. The manufacturer’s authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans.

2.21 DAMPERS AND ACTUATORS

A. Damper actuators shall be sized by the Systems Integrator for the intended application. Unless noted otherwise, dampers will be furnished by the Systems Integrator for all field installed dampers that are not included as part of the equipment. In general, provide opposed blade type dampers for modulating control and parallel type dampers for two-position control applications. Actuators shall be equal to Honeywell MS or ML series actuators.

B. Control Dampers: When indicated to be furnished by the Systems Integrator, control dampers shall be equal to Ruskin CD30VG2 or Honeywell D2 or D3 series dampers. Provide all automatic control dampers not specified to be integral with other equipment. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream. Blades shall not be over 8 inches wide nor less than 16-gauge galvanized steel triple V type for rigidity. Bearings shall be acetal, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts. Dampers shall be suitable for temperature ranges of -40 to 180F. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. wc. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. wc. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. wc. Side seals shall be stainless steel of the tight-seal spring type. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all low leakage control dampers with the temperature control submittal. Maximum leakage for low leakage dampers in excess

of sixteen inches square shall be 8 CFM per square foot at static pressure of 1 inch of WC. Low leakage damper blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage. Testing and ratings shall be in accordance with AMCA Standard 500. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized. Testing and ratings to be in accordance with AMCA Standard 500.

C. Damper Actuators: Damper actuators shall be provided for all automatic dampers. Damper actuators controlled through the DDC system shall be low voltage electronic type, either modulating or two-position, as required to achieve the intended sequence of operation. Provide with spring return when required for fail-safe operation. Modulating dampers shall be positive positioning in response to a 2 - 10 VDC or 4 - 20mA control signal. Actuator shall include the capability of adding auxiliary switches for position indication. Furnish actuators other than spring return type with a release button (clutch) or handle on the actuator to allow for manual override. Power supply to the actuator shall be by 120 VAC, 24 VAC, or 24 VDC and the actuator shall be furnished with a factory installed 3-foot cable with end fitting for field connection. All actuators shall be UL Listed by the manufacturer. Actuators shall be Honeywell MS or ML series actuators.

2.22 ELECTRICAL MISCELLANEOUS

A. Panels: All enclosures for DDC controllers and devices shall be fabricated in accordance with UL Standards from code gauge steel. Enclosures shall be provided with a continuous hinge on the door and a flush latching mechanism. Enclosures shall be shop painted with standard grade enamel coating. Back panels shall be furnished when required to facilitate installation of boards or accessories. All enclosures installed outdoors shall be constructed to NEMA 3R standards. All controllers shall be installed within an approved enclosure unless the controller will be installed within the control cabinet section of the equipment that it is intended to control. Enclosures shall facilitate the mounting of gauges, switches, pilot lights, and the like, on the face panel when required. Control devices that are mounted on the face of the panel shall be identified with engraved nameplates. Panels shall be Hoffman A1 series, or approved equal.

B. Power Transformers: Step-down power transformers shall be provided for all DDC controllers and associated accessory devices as required. Transformers shall be sized and selected to accommodate all connected accessory items. Transformers shall be UL Listed Class 2 type with 120 VAC primary, 24 VAC secondary. Transformers shall be Functional Devices TR series, or approved equal.

C. Relays: Miscellaneous control relays shall be provided as required to energize or control equipment and devices within the control system. Relays shall be located as close as practical to the controlled device (motor, motor starter, etc.). Where approved by NEC, relays may be installed within starters and equipment control panels where space is available. Relays installed outside of the controlled device shall be provided with a NEMA enclosure suitable for the location where installed. Relays shall be Functional Devices RIB series, or approved equal.

2.23 ELECTRICAL WIRING

A. Wiring: All wiring devices and accessories shall comply with the requirements of Division 26 and the NEC. All wiring shall be installed in a neat and professional manner. Control wiring

shall not be installed in power circuit conduits or raceways unless specifically approved for that purpose. All wiring, except plenum wiring (where allowed), shall be run in electrical conduits. Plenum cable will be allowed in concealed locations where accessible. All cable must be installed with 90° angles and strapped according the NEC.

B. Provide all interlock and control wiring. Provide wiring as required by functions as specified and as recommended by equipment and device manufacturers to achieve the specified control functions.

C. Low voltage conductors shall be stranded bare or tinned-copper with premium grade polymer alloy insulation. For shielded cable, furnish multi-conductor of overall polyester supported aluminum foil with stranded tinned copper drain wire to facilitate grounding. Coaxial shield shall be copper braided type. Provide shielded cable where recommended by the equipment or device manufacturer, grounded in strict accordance with the manufacture's recommendations.

D. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Terminations for Fire Alarm Control Panel (FACP) interface shall be accomplished by the Electrical Contractor or his designated subcontractor.

E. FMCS Systems Integrator shall provide power for all control devices and components from the closest available power source or as indicated on the power Drawings. When acceptable to the equipment manufacturer, low voltage power may be obtained from the internal equipment power source or transformer. Electrical Power for Systems Integrator's use has been provided at j-boxes located on plans.

F. Magnetic starters shall be furnished and installed by the Electrical Contractor.

G. Disconnects shall be furnished and installed by the Electrical Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.

B. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

C. Drawings of FMCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the FMCS Systems Integrator in accordance with the specifications in Divisions 23 and 26.

3.2 WIRING

A. All electrical control wiring and power wiring to the NAC, computers and network components shall be the responsibility of the FMCS contractor.

B. All wiring shall be in accordance with the the National Electrical Code and any applicable local codes. All FMCS wiring shall be installed in the conduit unless otherwise allowed by the National Electrical Code or applicable local codes. Where FMCS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.3 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the FMCS contractor at no expense to the Owner.

3.4 WARRANTY ACCESS

A. Pending owner pre-approval, the Owner shall grant to the FMCS contractor, reasonable access to the FMCS during the warranty period. The owner shall allow the contractor to access the FMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5 SOFTWARE LICENSE

A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner requires that all Niagara Ax based software and hardware on this project have the following Niagara Information Compatibility Statement (NICS):

1. Station Compatibility In = *
2. Station Compatibility Out = *
3. Tool Compatibility In = *
4. Tool Compatibility Out = *

Organizations without the above NICS shall not be allowed to bid.

B. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Ax based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

3.6 ACCEPTANCE TESTING

A. Upon completion of the installation, the FMCS contractor shall load all system software and start-up the system. The FMCS contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. The FMCS contractor shall coordinate the checkout of the system such that other appropriate Divisions have a representative present during system checkout.

B. The FMCS contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the Division 230900 contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.7 OPERATOR INSTRUCTION, TRAINING

A. During system commissioning and at such time acceptable performance of the FMCS hardware and software has been established, the contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. The FMCS contractor shall provide 12 hours of instruction to the owner's designated personnel on the operation of the FMCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the FMCS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:

1. Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
2. Warranty Follow Up: Two days (4 hours total) to be scheduled at the request of the owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

END OF SECTION 230900

SECTION 230900 – INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes the scope of work for the Facility Management and Control System that must be installed by a qualified FCMS Contractor and integrated to the Enterprise Server by the Enterprise Developer. This section also coordinates the responsibilities of the Mechanical and Electrical trade contractors pertaining to control products or systems, furnished by each trade, and that will be integrated by this Division.

B. All labor, material, equipment 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.

C. It is the owner's goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.2 SCOPE OF WORK

A. The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the owner's local or wide area network, depending on configuration. Each User shall configure a dashboard view of the pertinent data and this view shall be saved for later use. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through a standard Web browser, via the Internet and/or local area network. Each NAC shall communicate to LonMark/LonTalk (IDC), Bacnet (IBC), MODBUS and other open and legacy protocol systems/devices provided under this Division. In addition, from the controller(s) to the device(s) shall communicate to LonMark/LonTalk (IDC), Bacnet (IBC), MODBUS and other open and legacy protocol systems/devices provided under this Division. It is the owner's goal to eliminate any gateway or redundant device(s).

B. The Facility Management and Control System (FMCS) as provided in this Division shall be a JACE that provides an open automation infrastructure, an open license, and is available from multiple systems integrators. JACE shall have capability to integrate diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time over a secure network using a standard Web browser.

C. The work provided in this specification shall be performed by two entities. The FMCS Contractor shall have overall responsibility for the Division work. The Enterprise Developer shall be appointed by the Owner and shall provide all work at the Enterprise Server level. Owner will oversee and provide procurement for Enterprise Developer services. See Section 1.3 for more detail on the division of work.

D. All materials and equipment used shall be standard components. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

E. All wiring shall be done in accordance with all local and national codes.

1.3 DIVISION OF WORK

A. The FMCS contractor shall be responsible for all communicating thermostats, any miscellaneous controllers (IDC and IBC), control devices, control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring specified to be provided in Division 23.

B. The Division 26 (if applicable) contractors shall be responsible for all controllers Security NAC, control devices (BACnet, LONworks or Modbus), control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring specified to be provided in Division 26. These devices shall be configured and commissioned by Division 26 contractors and later managed in the NAC by FMCS contractor.

C. The FMCS contractor shall be responsible for the Network Area Controller(s) (NAC), software and programming of the NAC, graphical user interface software (GUI), User Configurable Dashboard software and connection of the NAC to the local or wide area network. FMCS shall also be responsible for development of all graphical screens, Web browser pages, setup of schedules, logs and alarms, and network management for all IDC or IBC devices provided in Division 23 and 26. IDC or IBC devices not provided by FMCS contractor shall be configured and commissioned by appropriate contractor and later managed in the NAC by FMCS contractor.

D. For reasons of security and consistency, it is the owner's intention to divide the work defined in this section into two sections. Work performed at the NAC level and below shall be performed by a qualified FMCS Systems Integrator. All work provided at the Enterprise Server and between the server and other systems shall be provided by the owner appointed Enterprise Developer. The Enterprise Developer shall be responsible for the "learning" of the WBI (web browser graphics) from the NAC to the Enterprise Server, the configuration of the Periscope Dashboard software and the global integration strategies across NACs and other intelligent building systems. The Enterprise Developer shall also be responsible for all Security integration at the Server level, if applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Products integrated and installed but not furnished under this section

1. Project specific equipment

a. JACE-8000 w/ IO-34 and 4.10 software
b. Wall Adapter – power supply for J-2..90-240 VAC 50/60 Hz. Wall Adaptor
c. Web version of WorkPlace AX
d. 8 Universal Inputs – 4 Form A Relay Outputs and 4 0-10 VDC Analog Outputs
e. 16 Universal Inputs – 10 Form A Relay Outputs and 8 0-10 VDC Analog
f. Veris meter (if applicable)
g. Electric pulse meter (if applicable)
h. Gas meter (if applicable)
i. Water meter (if applicable)

1.5 QUALITY ASSURANCE

A. The FMCS system shall be designed and installed, commissioned and serviced by factory trained personnel. Systems Integrator shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

1. The Systems Integrator shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the FMCS.
2. The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of FMCS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of FMCS systems similar in size and complexity to this project with a maintained service organization. Provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. All FMCS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 91 6category PAZX; Standard UL 864, categories UDTZ, and QVAX and be so listed at the time of Bid.

D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

E. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

F. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.

1. Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1.6 SUBMITTALS

A. Provide individuals experienced with the installation and startup of equipment related to this type of integration.

1. Eight copies of shop drawings of the entire FMCS shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. The FMCS shall submit an architecture layout that depicts devices from the JACE to NAC down to the device level.
2. A complete written Sequence of Operation shall also be included with the submittal package. The FMCS Systems Integrator shall coordinate data from other contractors supplying products and systems, as part of their package and shall provide catalog data sheets, wiring diagrams and point lists to the owner for proper coordination of work.

B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol. The FMCS Systems Integrator shall be responsible for integrating all network level devices into the overall trunk cable schematic diagrams for the entire Wide Area Network (WAN).

C. Submittal shall also include a complete point list of all points to be connected FMCS by the Systems Integrator. System integrator shall provide necessary point lists, protocol documentation, and factory support information for systems provided in their respective divisions but integrated into the FMCS.

D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner. Submittal shall also include a copy of the expected Dashboard viewlets being provided for owner configuration. The owner will provide an example of an acceptable graphic template. Where a particular graphic template does not exist, the Integrator shall create a similar template and gain approval during submittal process.

E. Upon completion of the work, provide a complete set of ‘as-built’ drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the ‘as-built’ drawings shall be provided in addition to the documents on compact disk. Division 23 and 26 contractors shall provide as-builts for their portions of work. The FMCS Systems Integrator shall be responsible for as-builts pertaining to overall FMCS architecture and network diagrams. All as built drawings shall also be installed into the FMCS server in a dedicated directory.

1.7 SPECIFIC NOMENCLATURE

A. Acronyms used in this specification are as follows:

FMCS	Facility Management and Control System
TCS	Temperature Control System
NAC	Network Area Controller
IDC	Interoperable Digital Lon Controller
FPC	Freely Programmable Lon Controllers
GUI	Graphical User Interface

WBI	Web Browser Interface
POT	Portable Operator’s Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement

1.8 SOFTWARE LICIENCE AGREEMENT

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

B. It is the owners express goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner.

1.9 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.10 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Systems Integrator's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.11 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire FMCS for a period of one year after beneficial use.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

C. With owner pre-approval, the on-line support services shall allow the local FMCS Systems Integrator to dial out over telephone lines to monitor and control the facility's building automation system. Pending owner approval, this remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

1. If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility.
2. If the problem cannot be resolved with on-line support services, the FMCS manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within a reasonable time frame.

1.12 ACCEPTABLE SYSTEM INTEGRATORS

A. The FMCS Systems Integrator shall provide NAC hardware, software and DDC components. NAC hardware and software shall be the Vykon brand. The successful FMCS Systems Integrator shall not have password access to the Enterprise Server and shall be restricted to NAC access.

B. The FMCS Systems Integrator shall have a technical support group accessible that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

C. Acceptable Systems Integrators of the hardware and software components as specified herein are as follows:

1. Open protocol systems

PART 2 - PRODUCTS

2.1 GENERAL

A. The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices and other devices as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, existing OPC if applicable, and other existing open and proprietary communication protocols if applicable in one open, interoperable system.

B. The supplied computer software shall employ component-based technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS

document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. 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.

2. 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.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and OBIX for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3

2. Cable; 100 Base-T, UTP-8 wire, category 5

3. Minimum throughput; 100 Mbps.

2.4 NETWORK ACCESS

A. Remote Access.

For Local Area Network installations the Owner shall provide a connection to the Internet to enable access via the customer's Intranet to a corporate server. FMCS Systems Integrator shall connect to IP drop provided by the Owner within 25 feet.

2.5 NETWORK AREA CONTROLLER (NAC)

A. The FMCS Systems Integrator shall supply one or more Network Area Controllers (NAC) as part of this contract to manage devices/points in all specification sections. This division shall be

required to integrate BACNet zone information provided by the Division 280000 Systems Integrator into the HVAC and Lighting Sequence of Operation. The number of NACs provided by this Systems Integrator is dependent on the type/quantity of devices and points. It is the responsibility of the FMCS Systems Integrator to coordinate with all Division contractors to determine the quantity and type of NACs needed to fulfill the operating sequences.

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 LonWorks controller data and BACnet controller data
7. Network Management functions for all LonWorks based devices

C. The Network Area Controller must provide the following hardware features as a minimum:

1. Two Ethernet Ports – 10/100 Mbps
2. One LonWorks Interface Port – 78KB FTT-10A (if applicable)
3. Two RS-485 ports
4. 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)
5. The NAC must be capable of operation over a temperature range of 32 to 122°F
6. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
7. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

E. NAC 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.

7. Control equipment and network failures shall be treated as alarms and annunciated.

8. Alarms shall be annunciated in any of the following manners as defined by the user:

   a. Screen message text
   b. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:

      1. Day of week
      2. Time of day
      3. Recipient

   c. Pagers via paging services that initiate a page on receipt of email message
   d. Graphic with flashing alarm object(s)

9. The following shall be recorded by the NAC for each alarm (at a minimum):

   a. Time and date
   b. Location (building, floor, zone, office number, etc.)
   c. Equipment (air handler #, accessway, etc.)
   d. Acknowledge time, date, and user who issued acknowledgement.
   e. Number of occurrences since last acknowledgement.

10. Alarm actions may be initiated by user defined programmable objects created for that purpose.

11. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

12. 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.

13. Provide a “query” feature to allow review of specific alarms by user defined parameters.

14. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

15. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

F. NAC Data Collection and Storage

1. The NAC shall have the ability to collect data for any property of any object and store this data for future use. See points list for required logs.
2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
    a. Designating the log as interval or deviation.
    b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
    c. 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.
    d. 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.
    e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
3. All log data shall be archived to a database in the Enterprise Server and the data shall be accessed from a standard Web browser and the Periscope Dashboard.
4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
5. All log data shall be available to the user in the following data formats:
    a. HTML
    b. XML
    c. Plain Text
    d. Comma or tab separated values
6. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
7. The NAC shall have the ability to archive its log data remotely to a server on the network. Provide the ability to configure the following archiving properties, at a minimum:
    a. Archive on time of day
    b. Archive on user-defined number of data stores in the log (buffer size)
    c. Archive when log has reached its user-defined capacity of data stores
    d. Provide ability to clear logs once archive.

G. NAC AUDIT LOG

1. 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 to a server. For each log entry, provide the following data:

    a. Time and date

    b. User ID

    c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

H. NAC DATABASE BACKUP AND STORAGE

1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Enterprise Developer shall coordinate with Owner to establish/implement a backup procedure.

2. 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.

3. 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.

2.6 WEB BROWSER CLIENTS

A. The system shall also allow use of an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. The system shall be capable of providing a rich user experience (including full use of the engineering toolset) through the use of java applets or a simple user interface using only HTML, CSS and JavaScript. Refer to Sequence of Operations for the client side display types that are required on this project.

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 graphics, schedules, calendars, logs, etc 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:

1. 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.

2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client (unless clearly stated in the sequence of operation). Any animated graphical objects supported by the GUI shall be supported by the Web browser interface. Enterprise Developer shall provide a FMCS Systems Integrator with a basis of performance/expectation for GUI. FMCS Systems Integrator shall use this standard

graphic template or modify the graphics slightly to achieve the desired specification requirement/outcome.

3. Storage of the graphical screens shall be in the Network Area Controller (NAC) and these graphics shall be "learned" by the Enterprise Server.

4. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.

5. Owner 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.

      1. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

      2. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

   b. 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.

   c. View logs and charts

   d. View and acknowledge alarms

   e. Setup and execute SQL queries on log and archive information

6. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide each specific user a defined home page based on their usage requirements. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

7. 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.

2.7 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 components shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control components 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 components to the application components to provide "real-time" data updates.

Any real-time data value or component property may be connected to display its current value on a user display. Systems requiring a separate software tool to create applications and browser user interface displays shall not be acceptable.

C. Programming Methods

1. Provide the capability to copy components from the supplied libraries, or from a user-defined library to the user's application. Components shall be linked by a graphical linking scheme by dragging a link from one component to another. Component links will support one-to-one, many-to-one, or one-to-many relationships. Linked components shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to components on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

2. Configuration of each component will be done through the component's property sheet using fill-in the blank fields, list boxes, and selection buttons. Requiring the use of custom programming, scripting language, or a manufacturer-specific procedural language for every component configuration will not be accepted.

3. 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.

4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database components shall not be allowed.

5. The system shall support component 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.

2.8 COMPONENT LIBRARIES

A. A standard library of components shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The components 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 components created in their application and store the new instances of these components 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 components and applications as they are developed.

D. All control components shall conform to the control component specified in the BACnet specification.

E. The component library shall include components 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 with the programming software:

1. 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 components 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.

2. For devices not conforming to the LonMark standard, provide a dynamic component 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.

3. For BACnet devices, provide the following components 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

4. For each BACnet component, provide the ability to assign the component a BACnet device and component instance number.

5. 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

2.9 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.

2.10 BACNet NETWORK MANAGEMENT

A. The Network Area Controller shall support the integration of device data from BACNet TCP/IP or BACNet MSTP system devices. The connection to the BACNet system shall be via an RS485, or Ethernet IP as required by the device.

B. Provide the required components in the library, included with the Graphical User Interface programming software, to support the integration of the Bacnet system data into the FMCS. Components provided shall include at a minimum:

1. Read/Write BACNet AI Points
2. Read/Write BACNet AO Points

3. Read/Write BACNet AV Points
4. Read/Write BACNet BI Points
5. Read/Write BACNet BO Points
6. Read/Write BACNet BV Points

C. All scheduling, alarming, logging and global supervisory control functions, of the BACNet system devices, shall be performed by the Network Area Controller.

D. The FMCS supplier shall provide a BACNet system communications driver. The equipment system vendor that provided the equipment utilizing BACNet shall provide documentation of the system's interface and shall provide factory support at no charge during system commissioning

E. BACnet Conformance:

1. Logic controllers shall as a minimum support MS/TP BACnet LAN type. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Logic controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

   a. Files Functional Group
   b. Reinitialize Functional Group
   c. Device Communications Functional Group

2. Refer to Section 22.2, BACnet Functional Groups, in the BACnet Standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

2.11 COMMUNICATING THERMOSTATS

A. The manufacturer of the Thermostat hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.

B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.

C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

D. Acceptable providers of the Communicating Thermostat hardware and software components as specified herein are as follows. Acceptance as a product provider does not provide approval to be an acceptable FMCS Systems Integrator.

   a. Reliable

b. ABB
c. Viconics
d. Distech Controls
e. Honeywell
f. Delta

E. Communicating Thermostats shall be LON or BACNet thermostats. FMCS Systems Integrator shall standardize on a single protocol for all thermostats and IDC/IBCs (if non thermostat controllers are needed) provided, i.e. all controllers provided shall be of the same protocol. This does not necessarily apply to controllers provided in other sections of the specification as there may be limited choices, but when possible, standardize on a single protocol.

2.12 LON DEVICES (IDC)

A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.

B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.

C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

D. Acceptable manufacturers of the hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable Systems Integrator.

a. Reliable
b. ABB
c. Viconics
d. Distech Controls
e. Honeywell
f. Delta

2.13 BACNET DEVICES (IBC)

A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.

B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.

C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

D. Acceptable manufacturers of the hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable Systems Integrator.

a. Reliable
b. ABB
c. Viconics
d. Distech Controls
e. Honeywell
f. Delta

2.14 LON/BACNET CONTROLLER(S) STANDARDS

A. Where possible provide LON Controllers or BACNet Controllers that can meet the required sequence of operation and can be configured rather that custom programmed. All controllers shall be designed for easy installation and servicing including removable enclosures, removable terminals, and factory applied labels for all I/O. All internal points shall be fully supported by the Graphical User Interface (GUI), allowing the user to easily modify them and monitor them. All of the internal programming points (e.g. variables, constants, PID's, timers, inputs and outputs) shall be exposed to the network on dedicated network variable outputs.

B. Performance Standards for Inputs - Provide software selectable universal inputs. Analog inputs - shall have the following minimum level of performance: 10 bit A to D resolution; manage thermistors with an accuracy of: ±0.9oF, and a Potentiometer. For VAV Applications provide a differential pressure input sensor built in to the controller with a adjustable range of .05" to 2" H20 (125-300PA) static pressure with a minimum accuracy of + or – 3%. Minimum response time shall be 0.5 seconds from input to output time.

C. Performance Standards for Outputs – Analog outputs shall have the following minimum level of performance: Tri-mode Voltage of 0-10 VDC (linear), digital 0-12 VDC (off/on) or PWM. All analog outputs shall be equipped with an auto-reset fuse. Output Resolution shall be a minimum 8 bits digital / analog converter. Digital outputs shall be provided with a minimum of a triac output rated at 24VAC and 1 amp. All analog outputs and power supply shall be fuse protected

D. Application Specific Controllers (ASC)- A controller designed through its I/O configuration and configurable control logic to be used for a specific type mechanical equipment. Typical applications are VAV boxes, Fan Coil Units, Roof Top Units, Unit Ventalators, Split DX Systems, Heat Pumps. Lighting Controls, etc. All ASC's shall conform to the LonMark or BACNet standards so long as such a standard exists for its intended application. The ASC shall allow the use of its spare I/O as dumb I/O to be shared over the network to NAC where a sequence of operation can be applied to the I/O. Such applications shall include but not be limited to exhaust fan control, heaters, light control, etc.

E. Freely Programmable Controllers (FPC) shall be a controller designed for more complex sequences of operations such as built up AHU's, central plant operations, electrical monitoring,

and control and management for chillers, boilers and generators. These FPCs are to allow for the flexibility of custom control programming to meet the needed sequences of operation.

2.15 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 components in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FMCS. Components provided shall include at a minimum:

1. Read/Write Modbus AI Registers
2. Read/Write Modbus AO Registers
3. Read/Write Modbus BI Registers
4. 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

E. Provide a Modbus Interface to the following equipment:

1. switchgear
2. packaged pumping system
3. building energy metering

2.16 THIRD PARTY INTEGRATION

A. The Network Area Controller shall support the integration of device data from the existing control system. The connection to the existing system shall be via an RS-232 connection between the Network Area Controller and the existing control system {if applicable on this project}.

B. Provide the required data points from the third party integration per sequence of operations and/or points list

2.17 SENSORS

A. All control items, except thermostats, sensors and transmitters located in rooms shall be properly identified with engraved plastic nameplates permanently attached. Nameplates shall have white letters on a black background.

B. Room thermostat, sensor and transmitter locations shall be coordinated to align vertically or horizontally with adjacent light switches or other control devices. Room thermostats and sensors shall be mounted with the bottom 5'-0" above the floor. Sensors installed in areas where they are subject to physical abuse (ex: gymnasiums) shall be furnished with protective

type aspirating guards. Sensors installed on exterior walls shall be installed on non-conductive (cork) sub-base. Sensors shall have plus or minus local control feature.

C. Temperature Sensors: Thermistor type with an accuracy of plus or minus 0.40 degree F over the entire control range. Sensors for pipe installations shall be immersion type, brass well, and thermistor with integral lead wire. Sensors for duct application shall be insertion probe type, stainless steel probe, integral handibox, and thermistor with integral lead wire. Space temperature sensors shall be compatible with the unit controller and shall be provided in a decorative metal or plastic enclosure (Nema 4X where exposed to pool environment). Space temperature sensors shall be provided with setpoint and temperature indication only. Outdoor temperature sensors shall be mounted inside a protective weather and sun shield and shall be located on a North wall.

D. Humidity Sensors: Thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%), 12 - 30 VDC input voltage, analog output (0 - 10 VDC). Operating range shall be 5 to 95% RH and -40 to 170 degree F. Duct mounted type sensors shall have a stainless steel insertion element, sealed to prohibit corrosion. Sensors shall be selected for wall, duct or outdoor type installation as appropriate.

E. Carbon Dioxide Sensors (CO2): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 50 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC/DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.

F. Differential Air Pressure Switch: Differential pressure switches for proving fan operation or sense dirty air filters shall be SPDT type, UL approved, and selected for the appropriate operating range of the equipment to which it is applied. Sensor shall have ¼" compression type fittings and shall have an adjustable setpoint. Furnish with ¼" barbed type static pressure tips.

G. Current Switches (Type 1): For proving fan or pump operational status, provide solid or split-core type current status switches with adjustable setpoint and solid-state internal circuitry. Current switch shall have induced power, trip point set adjustment to plus or minus 1% over a range of 1 to 135 amps, trip and power LED, and field adjustable to indicate both On-Off conditions and loss of load (broken belt, etc.). Units shall have a five-year manufacturer's warranty. Current switches shall be Hawkeye Series H-908 by Veris Industries, or approved equal.

H. Current Switches (Type 2): For proving fan or pump operational status, provide solid or split-core type current switches ("Go/No" type). Current switch shall have induced power, 100 percent solid state with no moving parts. Units shall have a five-year manufacturer's warranty. Current switches shall be Hawkeye series H-900 by Veris Industries, or approved equal.

I. Low Temperature Sensors: For sensing low temperatures in air handling units, provide SPST type switch, 35 to 45 degree F range, manual reset, vapor charged twenty foot long sensing element, and 120-volt electrical power connection. Low temperature sensor ("freeze-stat") shall be JCI Model A11A-1, or equal.

J. Pressure Transmitters: For sensing static pressure in a duct system (usually for VAV systems), provide a pressure transmitter with integral capacitance type sensing action, solid state

circuitry, accuracy of plus or minus 1% of range, zero and span adjustments, 10 to 35 VDC operating voltage, 4 to 20mA output, and integral inlet port connections. Select pressure range suitable for the application. Differential pressure transmitter shall be Ashcroft CXLdp, or approved equal.

K. Line Voltage Thermostats: For control of equipment using line voltage on-off thermostats (exhaust fans, unit heaters, etc.) provide 120 volt UL Listed wall mounted thermostats. Thermostat shall have a range of 50 to 90 degree F with minimum 2 degree F differential, snap acting switch, and dial adjustment for temperature setting. Line Voltage Thermostats shall be Honeywell series T631 series or approved equal.

L. Firestat: For sensing sudden increases in duct temperature (ex: fire condition), provide 120 volt UL Listed SPST switch with adjustable setpoint that breaks the circuit on a rise in temperature above the setpoint and de-energizes the air handling unit fan.

M. Aquastat: For sensing temperature of a fluid within a pipe system, provide 120-volt SPST strap-on type aquastat, temperature control range of 100 to 240 degree F (adjustable). Aquastat shall be JCI Model A19DAC-1, or equal.

N. Air Flow Monitoring Device

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ebtron Advantage Gold Series for use with GTx116 transmitters or a comparable product by one of the following:

    a. Tek-Air Systems
    b. Johnson Controls

2. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
3. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.

    a. Each sensor assembly shall contain two individually wired, hermetically sealed bead-in-glass thermistors.
    b. Thermistors shall be mounted in the sensor assembly using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment.
    c. The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output.
    d. The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output.
    e. Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics.
    f. Devices using chip-in-glass or diode-case chip thermistors are not acceptable.
    g. Devices using less than two thermistors in each sensor assembly are not acceptable.
    h. Devices using platinum wire RTDs are not acceptable.

i. Devices having electronic circuitry mounted in or at the sensor probe are not acceptable.
j. Pitot tubes and arrays are not acceptable.
k. Vortex shedding devices are not acceptable.

4. All Sensor Probes

a. Each sensor assembly shall independently determine the airflow rate and temperature at each measurement point.
b. Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST).
c. Airflow accuracy shall be +/-2% of Reading over the entire operating airflow range.

i. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.

d. Temperature accuracy shall be +/-0.15° F over the entire operating temperature range of -20° F to 160° F.
e. The operating humidity range for each sensor probe shall be 0-99% RH (non-condensing).
f. Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
g. Each sensor assembly shall not require matching to the transmitter in the field.
h. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter for each measurement location.

5. Duct and Probes

a. Probes shall be constructed of extruded, gold anodized, 6063 aluminum tube. All wires within the aluminum tube shall be Kynar coated.

b. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:

i. Insertion mounted through the side or top of the duct
ii. Internally mounted inside the duct or plenum
iii. Standoff mounted inside the plenum

c. The number of sensor housings provided for each location shall be as follows:

Duct Area (sq.ft.)	Total # Sensors / Location
<2	4
2 to < 4	6

4 to < 8	8
8 to <16	12
>=16	16

d. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.

6. Fan Inlet Probes

a. Sensor assemblies shall be mounted on 304 stainless steel housings.
b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
c. Mounting feet shall be constructed of 304 stainless steel.
d. The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.

7. Transmitters

a. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. The LCD display shall be capable of displaying individual airflow and temperature readings of each independent sensor assembly.
b. The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.
c. The transmitter shall have a power switch and operate on 24 VAC (isolation not required).

i. The transmitter shall use a switching power supply fused and protected from transients and power surges.
ii. The transmitter shall use “watch-dog” circuitry to assure reset after power disruption, transients and brown-outs.

d. All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.
e. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be installed at a location that is protected from weather and water.
f. The transmitter shall be capable of communicating with other devices using the following interface option: Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire)

9. The ATMD shall be UL listed as an entire assembly.

10. The ATMD shall carry the CE Mark for European Union shipments.

11. The manufacturer’s authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans.

2.21 DAMPERS AND ACTUATORS

A. Damper actuators shall be sized by the Systems Integrator for the intended application. Unless noted otherwise, dampers will be furnished by the Systems Integrator for all field installed

dampers that are not included as part of the equipment. In general, provide opposed blade type dampers for modulating control and parallel type dampers for two-position control applications. Actuators shall be equal to Honeywell MS or ML series actuators.

B. Control Dampers: When indicated to be furnished by the Systems Integrator, control dampers shall be equal to Ruskin CD30VG2 or Honeywell D2 or D3 series dampers. Provide all automatic control dampers not specified to be integral with other equipment. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream. Blades shall not be over 8 inches wide nor less than 16-gauge galvanized steel triple V type for rigidity. Bearings shall be acetal, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts. Dampers shall be suitable for temperature ranges of -40 to 180F. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. wc. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. wc. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. wc. Side seals shall be stainless steel of the tight-seal spring type. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all low leakage control dampers with the temperature control submittal. Maximum leakage for low leakage dampers in excess of sixteen inches square shall be 8 CFM per square foot at static pressure of 1 inch of WC. Low leakage damper blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage. Testing and ratings shall be in accordance with AMCA Standard 500. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized. Testing and ratings to be in accordance with AMCA Standard 500.

C. Damper Actuators: Damper actuators shall be provided for all automatic dampers. Damper actuators controlled through the DDC system shall be low voltage electronic type, either modulating or two-position, as required to achieve the intended sequence of operation. Provide with spring return when required for fail-safe operation. Modulating dampers shall be positive positioning in response to a 2 - 10 VDC or 4 - 20mA control signal. Actuator shall include the capability of adding auxiliary switches for position indication. Furnish actuators other than spring return type with a release button (clutch) or handle on the actuator to allow for manual override. Power supply to the actuator shall be by 120 VAC, 24 VAC, or 24 VDC and the actuator shall be furnished with a factory installed 3-foot cable with end fitting for field connection. All actuators shall be UL Listed by the manufacturer. Actuators shall be Honeywell MS or ML series actuators.

2.22 ELECTRICAL MISCELLANEOUS

A. Panels: All enclosures for DDC controllers and devices shall be fabricated in accordance with UL Standards from code gauge steel. Enclosures shall be provided with a continuous hinge on the door and a flush latching mechanism. Enclosures shall be shop painted with standard grade enamel coating. Back panels shall be furnished when required to facilitate installation of boards or accessories. All enclosures installed outdoors shall be constructed to NEMA 3R standards. All controllers shall be installed within an approved enclosure unless the controller will be installed within the control cabinet section of the equipment that it is intended to

control. Enclosures shall facilitate the mounting of gauges, switches, pilot lights, and the like, on the face panel when required. Control devices that are mounted on the face of the panel shall be identified with engraved nameplates. Panels shall be Hoffman A1 series, or approved equal.

B. Power Transformers: Step-down power transformers shall be provided for all DDC controllers and associated accessory devices as required. Transformers shall be sized and selected to accommodate all connected accessory items. Transformers shall be UL Listed Class 2 type with 120 VAC primary, 24 VAC secondary. Transformers shall be Functional Devices TR series, or approved equal.

C. Relays: Miscellaneous control relays shall be provided as required to energize or control equipment and devices within the control system. Relays shall be located as close as practical to the controlled device (motor, motor starter, etc.). Where approved by NEC, relays may be installed within starters and equipment control panels where space is available. Relays installed outside of the controlled device shall be provided with a NEMA enclosure suitable for the location where installed. Relays shall be Functional Devices RIB series, or approved equal.

2.23 ELECTRICAL WIRING

A. Wiring: All wiring devices and accessories shall comply with the requirements of Division 26 and the NEC. All wiring shall be installed in a neat and professional manner. Control wiring shall not be installed in power circuit conduits or raceways unless specifically approved for that purpose. All wiring, except plenum wiring (where allowed), shall be run in electrical conduits. Plenum cable will be allowed in concealed locations where accessible. All cable must be installed with 90° angles and strapped according the NEC.

B. Provide all interlock and control wiring. Provide wiring as required by functions as specified and as recommended by equipment and device manufacturers to achieve the specified control functions.

C. Low voltage conductors shall be stranded bare or tinned-copper with premium grade polymer alloy insulation. For shielded cable, furnish multi-conductor of overall polyester supported aluminum foil with stranded tinned copper drain wire to facilitate grounding. Coaxial shield shall be copper braided type. Provide shielded cable where recommended by the equipment or device manufacturer, grounded in strict accordance with the manufacture’s recommendations.

D. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Terminations for Fire Alarm Control Panel (FACP) interface shall be accomplished by the Electrical Contractor or his designated subcontractor.

E. FMCS Systems Integrator shall provide power for all control devices and components from the closest available power source or as indicated on the power Drawings. When acceptable to the equipment manufacturer, low voltage power may be obtained from the internal equipment power source or transformer. Electrical Power for Systems Integrator’s use has been provided at j-boxes located on plans.

F. Magnetic starters shall be furnished and installed by the Electrical Contractor.

G. Disconnects shall be furnished and installed by the Electrical Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.

B. Install system and materials in accordance with manufacturer’s instructions, and as detailed on the project drawing set.

C. Drawings of FMCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the FMCS Systems Integrator in accordance with the specifications in Divisions 23 and 26.

3.2 WIRING

A. All electrical control wiring and power wiring to the NAC, computers and network components shall be the responsibility of the FMCS contractor.

B. All wiring shall be in accordance with the the National Electrical Code and any applicable local codes. All FMCS wiring shall be installed in the conduit unless otherwise allowed by the National Electrical Code or applicable local codes. Where FMCS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.3 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the FMCS contractor at no expense to the Owner.

3.4 WARRANTY ACCESS

A. Pending owner pre-approval, the Owner shall grant to the FMCS contractor, reasonable access to the FMCS during the warranty period. The owner shall allow the contractor to access the FMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5 SOFTWARE LICENSE

A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner requires that all Niagara Ax based software and hardware on this project have the following Niagara Information Compatibility Statement (NICS):

1. Station Compatibility In = *
2. Station Compatibility Out = *
3. Tool Compatibility In = *
4. Tool Compatibility Out = *

Organizations without the above NICS shall not be allowed to bid.

B. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Ax based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

3.6 ACCEPTANCE TESTING

A. Upon completion of the installation, the FMCS contractor shall load all system software and start-up the system. The FMCS contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. The FMCS contractor shall coordinate the checkout of the system such that other appropriate Divisions have a representative present during system checkout.

B. The FMCS contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the Division 230900 contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.7 OPERATOR INSTRUCTION, TRAINING

A. During system commissioning and at such time acceptable performance of the FMCS hardware and software has been established, the contractor shall provide on-site operator instruction to

the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. The FMCS contractor shall provide 12 hours of instruction to the owner's designated personnel on the operation of the FMCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the FMCS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:

1. Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
2. Warranty Follow Up: Two days (4 hours total) to be scheduled at the request of the owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

END OF SECTION 230900

SECTION 232000 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 This section includes all pipe, pipe fittings, hangers, and supports, etc. as may be required to provide a complete piping system.

1.2 Testing of all piping shall be made in the presence of the Engineer or a designated representative of the Owner. No piping shall be covered or put into operation before such testing has been approved. Covered pipe shall be exposed at contracts expense. Engineer shall be given 48 hours written notification of test.

1.3 The actual arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainage, etc. shall be maintained.

1.4 All piping shall be provided with end caps or have ends covered prior to installation.

PART 2 - PRODUCT

2.1 Refrigerant Piping

A. Refrigerant piping shall be type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation. All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.

B. Refrigerant piping fittings shall be sweat type wrought copper.

C. All refrigerant piping shall be brazed.

D. Copper tubing, which is out of round, will not be acceptable.

E. Not notching or mitering of copper tubing will be permitted.

F. Do not allow piping to rub against masonry when expanding and contracting.

G. Close and protect open ends of piping until final connections are made. Such closing shall be made with fittings, which cannot be easily removed. Caps or plugs shall be made with fittings, which cannot be easily removed. Caps or plugs shall be required at all times during construction so that no pipes are left open at the end of any day’s work, even though continuation is expected the next day.

H. Copper pipe ends shall be reamed, sanded and deburred before soldering. Non-corrosive flux shall be used.

I. Test refrigerant piping in accordance with the NC Building Code.

2.2 Condensate Drain Pipe

A. Drain pan condensate piping shall be Type “L” copper with all joints soldered with 95-5 solder.

B. Terminate condensate drain lines as shown on drawings. Condensate drains from rooftop units are to be routed to nearest roof drain.

C. Provide unions on both sides of trap.

PART 3 - EXECUTION

3.1 No “Stub-In” shall be permitted.

3.2 All insulated piping shall be protected by saddles at horizontal support points or by insulation protectors if the insulation has a vapor barrier. Saddles where used shall be welded to the pipe.

3.3 Sleeves shall be provided wherever pipes pass through walls, floors and ceilings. Sleeves shall be Schedule 40, black steel, 1/2" in diameter larger than the pipe and insulation on the pipe. Sleeves through walls and ceilings shall be flush. Sleeve through floors shall extend two inches above finished floor. Sleeves in exterior walls shall be caulked and made watertight.

END OF SECTION 232000

PART 1 - GENERAL

1.1 This Section includes ductwork, splitter dampers, balancing dampers, air deflection devices, etc. required for a complete system.

1.2 The Drawings are intended to indicate, with reasonable accuracy, the location of components and the general arrangement of the system. All offsets, bends fittings and other devices, not shown but required for the full operation of the system, shall be provided.

1.3 Refer to specification Section 230700 for duct insulation.

PART 2 - PRODUCT

2.1 Low and Medium Pressure Ductwork.

A. Round and rectangular ductwork shall be of gauges and construction methods as indicated in the latest ASHRAE Guide and SMACNA Standard.

B. Splitter dampers, balancing dampers, turning vanes and air deflection devices shall be installed as shown on the plans and/or where required for the proper control of airflow.

C. All take-offs to diffusers shall be tapered type taps with factory damper and locking quadrant.

D. Ductwork to be 2” pressure.

E. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.

F. Interior Ductwork and reinforcements shall be G60 (Z180) galvanized (0.60 ounces per square foot (180 g/m²) total zinc coating for two sides per ASTM A90) unless noted otherwise.

G. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F (-29°C) to +175°F (80°C), resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M.

2.2 Flexible Ductwork

A. Ducts shall be insulated type with foil wrapper complying with NFPA Standard No. 90A and UL181.

B. All flexible ducts shall have a factory installed 1" thick 1.5 lb./cu. ft. fiberglass insulation with a seamless vinyl vapor barrier.

C. Length of flexible duct shall not exceed 10 feet.

D. Flexible duct shall be secured and sealed in place with mastic to hard duct collars at each end, with nylon tie-wraps on the wire enforced inner mylar skin, followed by the insulation layer and then the exterior vapor layer secured with another tie-wrap.

2.3 Conditioned Air Exposed Ductwork Oval/Round Ductwork

A. Exposed shall be round, 18 gauge spiral lock seam with paintable finish, double wall and internally insulated at the factory. Inner wall shall be perforated.

B. Duct shall be fastened using sheet metal screws only and no duct tape.

2.4 Fabric Connectors

A. Fabric connectors shall be installed between all fans or fan units and metal ducts or casings to prevent transfer of fan or motor vibration.

B. The fabric connectors shall be completely flexible material which shall be in folds and not drawn tight.

C. Fabric connectors shall be of glass fabric double coated with neoprene, with UL approval. Weight = 30 oz. per square yard (1017 g/m2) minimum. Fabric shall not be affected by mildew and shall be absolutely waterproof, airtight and resistant to acids, alkalis, grease and gasoline, and shall be noncombustible.

D. Fabric connections shall not exceed 6" (150 mm) in length on ductwork that has a positive pressure. On ductwork that has a negative pressure, the length shall not exceed 2" (50 mm) in length.

E. All corners shall be folded, sealed with mastic and stapled on 1" (25 mm) centers.

F. Fabric connectors shall not be painted.

G. Unless otherwise shown on the drawings, the fabric connection at the inlet to centrifugal fans shall be at least one duct diameter from the fan to prevent inlet turbulence.

H. Materials:

1. Durodyne MFN-4-100
2. Vent Fabrics, Inc.
3. "Ventglas"
4. Proflex PFC3NGA

PART 3 - EXECUTION

3.1 Turning vanes shall be installed in square elbows for all ductwork.

3.2 Duct transitions, splitter dampers, and balancing dampers shall be constructed of gauges and materials as indicated in ASHRAE Guide and SMACNA Standards.

3.3 Hangers and supports for ductwork shall be of metal bands, angles and rods as indicated in ASHRAE Guide and SMACNA Standards. The minimum bandwidth shall be 1", 16 gauge, galvanized steel.

3.4 Where ductwork passes through floors and walls, the space around the ducts shall be sealed in an approved manner with mineral wool insulation, and/or proper fire seal material approved by the State or Local Inspector.

3.5 In exposed areas and mechanical rooms, ductwork openings shall be finished with a metal collar.

3.6 Ductwork shall be cross-braced and reinforced properly with galvanized steel angles as recommended by SMACNA Standards.

3.7 Where ductwork behind grilles or diffusers is visible, it shall be painted with two coats of flat black base fire retardant paint.

3.8 Duct connections to outside air louvers shall be pitched to drain outside and shall be soldered watertight.

3.9 Tape all low-pressure joints with Hardcast or approved equal for completely airtight system.

3.10 All medium pressure joints are to be sealed in accordance with SMACNA standards for ductwork 2” W.C. and greater. All ducts shall be air tight, rigid and free from vibration and noise.

3.11 Duct dimensions shown on the drawings are net inside dimensions.

3.12 Where ductwork is lined, as noted in Section 230700, the duct insulation thickness shall be added to the listed ductwork dimensions for final duct size.

END OF SECTION 233000

PART 1 - GENERAL

1.1 Provide all fans, roof caps, etc., of the type and capacities indicated on the Drawings.

1.2 Fans, roof caps, curbs, etc., shall be by the same manufacturer.

1.3 Fans shall be by Greenheck, Loren Cook, ILG, Twin City Fans, or equal.

PART 2 - PRODUCT

2.1 All fans, roof caps, etc., shall be as scheduled on the Drawings.

2.2 All fans shall be equipped with 1/2" mesh bird screen, gravity damper.

2.3 All fan motors shall have vibration isolators, motor housing shall be grounded, and motor overload protection shall be provided.

2.4 All curbs shall be of the prefab insulated type.

2.5 Provide NEMA 3R rated disconnect switch.

2.6 Fan housing:

1. Heavy gauge steel reinforced and braced with steel angle framework.
2. Cleaned, phosphatized and painted with enamel or constructed entirely of galvanized steel.
3. Removable access panels for fan removal.
4. Insulate fan section interior with 1" (25 mm) thick, 3/4 lb. (12 kg/m3) density fiberglass.

2.7 Fan Construction:

1. Double width, double inlet, forward curved centrifugal, dynamically balanced.
2. Grease lubricated ball bearings, rated for 200,000 hours L-50 life at design operating conditions.
3. Extend lubrication lines for all bearings to an easily accessible location.
4. OSHA belt guards with openings for tachometer readings.

2.8 Fan Motors and Drives:

1. Motor shall have slide rails, adjusting screws, anchor bolts and bedplates.
2. Adjust motor mounting bracket for tightening belts.
3. Open drip-proof motors with grease lubricated bearings, minimum 1/3 HP (0.25 kW).

PART 3 - EXECUTION

3.1 Fans and roof caps shall be installed as shown on the plans.

3.2 Wall openings and locations are to be coordinated with the other trades.

3.3 Fan motors and all other electric components shall bear the UL or other acceptable third party testing agency label.

END OF SECTION 233400

SECTION 233700 – AIR DISTRIBUTION

PART 1 - GENERAL

1.1 Furnish and install air distribution devices of the type, size and configuration indicated on the drawings.

1.2 Refer to Architectural Reflected Ceiling Plan and Schedule for types of ceiling specified, and provide compatible frames on air distributions devices

PART 2 - PRODUCT

2.1 Diffusers, Grilles, and Register

A. Surface mounted devices shall have sponge gaskets.

B. Devices shall be of steel construction with baked on enamel finish, unless otherwise noted.

C. All devices shall be by Price, Nailor, Titus, Metalaire, or approved equivalent.

D. Ceiling mounted diffusers shall have insulation applied to metal top and neck to prevent sweating. Insulation shall match duct insulation.

E. Soffit grilles shall be extruded anodized aluminum with ¼" x ¼" insect screen.

F. Return and exhaust grilles in lay-in ceilings shall have full louvered face (24" x 24").

G. Devices in moist and humid spaces shall be of aluminum construction.

H. Provide heavy-duty steel return grilles (in gymnasiums, multi-purpose rooms, etc) or in all locations where the grille is within 8' off the floor.

2.2 Louvers

A. Louvers shall be 12 gauge extruded aluminum with drainable blades, unless otherwise noted.

B. Louvers shall be provided with ½ " x ½ " insect screen.

C. Louvers shall be Arrow, Ruskin, Air Balance or approved equivalent.

D. Provide louvers with required mounting sleeves/support. Coordinate opening with general contractor.

E. Louver indicated on drawings to have motorized damper shall be interconnected with fans indicated, and shall open when the fan is energized. This Contractor shall provide and make all interconnecting control wiring from the fan to the damper

PART 3 - EXECUTION

3.1 Air distribution devices shall be mounted level, straight, and flush with walls or ceilings.

3.2 Color shall be as indicated on drawings, or as selected by the Architect/Engineer.

3.3 Locations of all air distribution devices shall be coordinated with ceiling and lighting work.

3.4 Provide submittals data to include, cfm, pressure drop, dimensional, velocity and noise criteria data.

END OF SECTION 233700

SECTION 238143 – SPLIT SYSTEM HEAT PUMP

PART 1 - GENERAL

1.1 Furnish and install a direct expansion heat pump indoor unit with capacity as indicated on the plans.

1.2 Unit shall be completely factory assembled and pretested.

1.3 Unit shall be Trane, Carrier, Lennox, Daikin, LG, or approved equivalent.

PART 2 - PRODUCT

2.1 Air Handling Unit/Fan Coil

A. Casing shall be Galvanneal steel, bonderized with baked enamel finish.

B. Unit shall use R-454B. Provide all manufacturer accessories for monitoring/purging. Provide pipe labeling per ASHRAE 15 for A2L refrigerants.

C. Fan section shall have forward curved blades, centrifugal type, belt or direct drive. Fan shall be statically and dynamically balanced and shall run on permanently lubricated bearings.

D. Cooling coils shall be of non-ferrous construction with mechanically bonded aluminum plate fins on copper tube.

E. Air filters shall be 2” deep MERV-8 pleated media filters.

F. Casing shall be insulated with fire retardant insulation in accordance with NFPA 90A. Insulation shall be secured to casing panels with waterproof cement and permanent fasteners.

G. A condensate drain pan shall be furnished with threaded pipe connections and shall extend completely under the coil section. Condensate drain lines shall be insulated copper.

H. Electric heater assembly shall include circuit breakers, automatic re-setting limit switches and heat limiter for primary and secondary over-current and thermal protection.

I. Accessories shall be as indicated on the drawings.

J. Coil design pressure shall be a maximum off 500 psig and a maximum design temperature of 250°F.

K. Provide 1/4" (6 mm) thru 3-5/8" (92 mm), 500 psi (3445 kPa), globe or angle pattern, brazed, brass body, cleaned-dried-plugged and tagged at factory for refrigerant service.

L. Solenoid Valve: AHRI 760; pilot operated; copper or brass body and internal parts; synthetic seat; stainless steel stem and plunger assembly; extended solder ends to permit installation without disassembly; maximum working pressure of 500 psi (3445 kPa); normally closed.

M. Expansion valves shall be Angle or Straight Thru Type: ANSI/AHRI 750; materials suitable for system refrigerant, external equalizer, adjustable super heat setting, balanced port design, suitable for horizontal or vertical installation, with replaceable capillary tube and remote sensing bulb. Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10°F (-5°C) super heat. Select to avoid being undersized at full load or excessively oversized at part load.

N. Filter driers shall be Replaceable Cartridge Angle Type: ANSI/AHRI 710, UL listed, brass or epoxy-coated steel shell, molded desiccant high-water capacity filter core(s); maximum working pressure of 500 psi (3445 kPa); maximum temperature of 275°F (135°C).

O. Moisture and liquid indicators shall be UL listed, with copper, brass, or copper-plated steel body, flared or solder ends, extended fittings in units up to at least 1-1/8" to allow brazing without removing the cartridge, sight glass, color coded paper moisture indicator that is replaceable without breaking piping connections for units up to 1-1/8" size, and plastic cap; maximum working pressure of 500 psi, and maximum temperature of 200°F.

2.2 Outdoor Unit

A. Cabinet shall be single, enclosed, and weatherproof casing or galvanized steel bonderized and finished with baked enamel. A base pan drain connection shall be provided. Panels shall be easily removable for service access.

B. Compressor system shall consist of serviceable hermetic compressor. Compressor shall have service shut-off valves; suction pressure operated capacity control unloader, suitable vibration isolators and crankcase heater.

C. Condenser and evaporator coils shall have aluminum plate fins mechanically bonded to copper tubes.

D. Outdoor fans shall be propeller type, direct driven. All motors shall have overload protection and suitable vibration isolators. Cooling system shall be protected by fusible plug, high and low pressure stat, compressor motor overloads, anti-cycling timer device (5 minutes). Controls shall include low voltage control circuit transformer, compressor and fan motor safety controls with automatic reset, high and low pressure cutout switches and terminals for accessory electrical connections.

PART 3 - EXECUTION

3.1 Unit shall be installed as shown on the plans, in strict accordance with manufacturer's recommendations.

3.2 Controls shall be as indicated on the plans.

3.3 Provide 5-year compressor warranty.

3.4 Provide with spare belts for any belt driven fans.

3.5 Provide with (2) sets of filters. Contractor to install one set at system start-up and a second set at completion of project.

END OF SECTION 238143

ELECTRICAL SPECIFICATIONS

26 00 00	GENERAL PROVISIONS (ELECTRICAL) CONTRACT
26 05 20	WIRES AND CABLES
26 05 33	BOXES AND CABINETS
26 05 45	CONDUIT AND CONDUIT FITTINGS
26 05 53	ELECTRICAL IDENTIFICATION
26 22 13	DRY TYPE TRANSFORMERS
26 24 16	PANEL BOARDS AND CIRCUIT BREAKERS
26 27 26	WIRING DEVICES
26 27 27	DISCONNECTS
26 51 00	LIGHTING FIXTURES
27 10 00	TELECOMMUNICATION DISTRIBUTION SYSTEM
28 31 00	ADDRESSABLE FIRE ALARM SYSTEM

SECTION 26 00 00 - GENERAL PROVISIONS (ELECTRICAL) CONTRACT

PART 1 - GENERAL

1.1 Scope of Work

A. This Contractor shall provide all materials, equipment and labor necessary to install and set into operation the electrical equipment as shown on the Engineering Drawings and as contained herein.

1.2 Quality Assurance

A. See the General and Supplementary General Conditions.

B. All work shall be in accordance with the North Carolina State Building Code, which includes the 2020 edition of the North Carolina Electrical Code.

C. Wherever the words "Approved", "Approval", and "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.

D. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

E. All material and equipment that the Contractor proposes to substitute in lieu of those specified shall be submitted to the Engineer ten (10) days prior to the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified. Article 8 of the General Conditions will be followed for substitutions after award of Contract.

1.3 Submittals

A. See General and Supplementary General Conditions and Division 1.

B. Within ten (10) days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit for approval to the Architect/Engineer a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time. Six (6) sets of submittal data shall be provided for approval.

C. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitution for specified items. Acceptance for approval shall be in writing from the Engineer.

D. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent on receipt of these as-built plans.

E. The Contractor shall furnish four (4) bound sets of maintenance and operating instructions, parts lists, electrical circuit wiring diagrams, all submittal data, and sufficient manufacturer's literature to operate and maintain all equipment.

F. The Contractor shall submit to the Engineer a duplicate set of final electrical inspection certificates prior to final payment.

1.4 Product Delivery, Storage and Handling

A. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B. The Contractor shall protect all material and equipment from breakage, theft or weather damage. No material or equipment shall be stored on the ground.

C. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

1.5 Work conditions and Coordination

A. The Contractor shall review the mechanical plans to establish points of connection and the extent of electrical work to be provided in his Contract.

B. This Contractor shall be responsible for all electrical work and make final connections to equipment installed in his Contract. Unless otherwise noted, this Contractor shall wire to disconnect switches, junction boxes, or circuit breakers as provided in his Contract.

C. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be approved by Architect/Engineer and shall be at the Contractor’s expense with no extra cost to the owner.

1.6 Guarantee

A. See the General and Supplementary General Conditions.

B. Where extended warranties or guarantees are available from the manufacturer, the Contractor shall prepare the necessary Contract Documents to validate these warranties as required by the manufacturer and present them to the Owner.

PART 2 - PRODUCT

2.1 Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Materials and equipment found defective shall be removed and replaced at the Contractor's expense.

2.2 The Contractor shall provide nameplates for identification of all equipment, switches, panels, transformers, etc. The nameplates for 120/208-volt panels shall be laminated phenolic plastic, blue front and back with white core, white engraved letters (1/2" minimum) etched into the white core. Name tags to be mounted with self-tapping sheet metal, stainless steel screws with the sharp end protected.

2.3 All materials and equipment shall be approved third party agencies or bear re-examination listing where such approval has been established for the type of device in question. Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to Label Electrical & Mechanical Equipment

PART 3 - EXECUTION

3.1 Inspection

A. If any part of this Contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the Contractor shall examine and measure such contiguous work and report to the Architect or Engineer in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the Contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible for any defects in this work consequent thereon and will not be relieved of the obligation of any guarantee because of any such imperfection or condition.

B. It is the responsibility of the electrical contractor to notify **Beaufort County Electrical Inspector** to schedule required inspections including rough-in, above ceiling and final inspections.

3.2 Installation

A. All work shall be performed in a manner indicating proficiency in the trade.

B. All conduit, pipes, ducts, etc., shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

C. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

D. All patching shall be done in such a manner as to restore the areas or surfaces as to match existing finishes.

E. The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish and install all sleeves or openings through poured masonry floors or walls above

grade required for passage of all conduits, pipes or duct installed by him. The Contractor shall furnish and install all inserts and hangers required to support his equipment.

F. Grounding

1. All grounding shall be in accordance with the requirements of the NEC. The main service ground shall be bare copper wire in conduit clamped to building structural steel. Bond ground wire to conduit at each end. See the Electrical Riser Diagram.
2. Install a separate green grounding conductor with the circuit conductors in each conduit. Use of the conduit only shall not be an acceptable means of equipment grounding.
3. Install ground wire in all flexible connections (flex shall not be acceptable for grounding purposes).
4. All grounding conductors shall be sized per Article 250.122 of the NEC.
5. The ground system shall be tested with a ground resistance tester and the test report submitted to the Engineer. If resistance exceeds 25 ohms provide an additional driven ground rods separated by a minimum of 6' interconnected with #3/0 copper. The test results be made available within project construction records for SCO review at scheduled Final Inspection by SCO representatives.
6. All ground points shall be accessible for inspection.
7. Boxes with concentric, eccentric or over-sized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC Table 250.122 and lugged to the box.
8. Grounding Conductors, where, insulated shall be colored solid green. Conductors intended as neutral shall be colored white on 120/208-volt circuits and gray on 277/480-volt circuits
9. The raceway system shall not be relied on for equipment ground continuity. A green equipment grounding conductor, properly sized per NEC Table 250-122, shall be run in ALL raceways except for telecommunications, data, audio systems, and low voltage raceways for fire alarm systems.
10. Grounding electrode conductors #4 AWG and larger shall be installed in a raceway system.
11. The electrical service shall be grounded by three (3) means, when available:

    a. To the metallic cold water pipe, as per NEC Article 250-52.
    b. To the steel frame of the building, provided the building frame is effectively grounded. In new construction, effectively ground and bond steel building frame.
    c. To ground rod(s). ground rods shall be 10 feet long and 3/4-inch in diameter and shall be of copper-clad steel construction. All ground connections shall be accessible. Provide a minimum of one test well at one driven ground rod.

12. The gas piping system shall be bonded to the equipment ground as required per the NEC and NC Fuel Gas Code.
13. Identify each grounding electrode conductor that is connected to a common ground bus. The common ground bus shall not be less than 2” high by 1/4” thick, with length determined by the Engineer.

G. Electrical Identification

1. Furnish and install engraved laminated phenolic nameplates for all safety switches, panel boards, transformers, switchboards, motor control centers and other electrical equipment supplied for the project for identification. Nameplates shall be securely attached to equipment with self-tapping stainless-steel screws; if the screw sharp end is protected; otherwise, Rivets shall be used. Letters shall be approximately 1/2-inch-high minimum.

Embossed, self-adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be:

a. Blue surface with white core for 120/208-volt equipment.
b. Black surface with white core for 277/480-volt equipment.
c. Bright red surface with white core for all equipment related to fire alarm system.
d. Dark red (burgundy) surface with white core for all equipment related to security.
e. Green surface with white core for all equipment related to “emergency” systems.
f. Orange surface with white core for all equipment related to telephone systems.
g. Brown surface with white core for all equipment related to data systems.
h. White surface with black core for all equipment related to paging systems.
i. Purple surface with white core for all equipment related to TV systems.

2. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet.
3. All outlet boxes, junction boxes, and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This includes covers on boxes above lift-out and other type accessible ceilings.

3.3 Performance

A. The Contractor shall perform all excavation, backfilling, and patching operations as indicated on the drawings.

3.4 Erection

A. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

3.5 Field Quality Control

A. The Contractor shall conform to the requirements of Division 3 for concrete testing.

B. The Contractor shall test his entire installation and shall furnish the labor and materials required for these tests. Tests shall be performed in accordance with the requirements of the section of the specifications and in accordance with the requirements of the State Ordinances and Codes, and the National Electrical Code. The Contractor shall notify the Engineer of his readiness for such test. Final inspections by the Beaufort County Electrical Inspector and N.C. Department of Administration (State Construction Office) are required. Final inspection and acceptance certificates are required, prior to authorization of final payment.

C. Testing required for compliance with the Contract shall be stated in subsequent sections. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information. All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.

D. Documentation

1. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.
2. All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.

3.6 Adjust and Clean

A. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for the intended service. In no event shall nameplates be painted.

C. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract (in the presence of the Engineer).

END OF SECTION 26 00 00

SECTION 26 05 33 - BOXES AND CABINETS

PART 1 - GENERAL

1.1 The Electrical Contractor shall provide junction boxes, pull boxes, cable, support boxes, and wiring troughs as required by NEC and as otherwise indicated in the Drawings.

1.2 All necessary mounting hardware and accessories shall be provided for a complete installation.

PART 2 - PRODUCT

2.1 Outlet and junction boxes shall be 4" minimum size, octagonal in ceilings, 4" square or rectangular (4" x 4" minimum for walls) except as noted below. Ceiling outlet boxes shall not be less than 1 1/2" deep, but in no case shall the size and depth of boxes be less than the required by the NEC.

2.2 Outlet boxes shall be equipped with plaster rings of appropriate depth to finish flush with finished walls. Outlets in exposed masonry wall shall be equipped with extra deep square corner tile rings so that box may be installed in the core of the block.

2.3 Outlets for concealed work and ceiling outlets for exposed work shall be galvanized stamped steel. Boxes shall be as manufactured by Steel City Electric Company, Metropolitan, B & C or equivalent.

2.4 Wall outlets for exposed conduit work shall be Crouse- Hinds, Appleton, Walker, or equal, series FS and FD switch and receptacle threaded hub boxes, with matching FS and FD covers.

2.5 Junction boxes for change of direction or feeder taps shall be furnished where required, shall be of adequate size to prevent crowding conductors in accordance with the requirements of the electrical code and job requirements and shall be accessible.

2.6 Junction boxes on finished wall and ceilings shall be flush with covers.

2.7 Junction boxes larger than 5" square shall be galvanized and without pre-formed knockouts.

PART 3 - EXECUTION

3.1 Boxes and troughs shall be supported independently of conduit entering them. Brackets, threaded rod hangers with lock nuts, bolts, or other suitable supporting methods may be used.

3.2 Thru-the-wall outlet boxes shall not be permitted. Outlet boxes shown back to back on plans, shall be separate boxes connected where required using a loop of flexible metallic conduit with ground wire. Boxes shall be separated a minimum of 18 inches apart.

3.3 In general, outlets shall be installed at the heights indicated on the fixture and symbol legend.

3.4 Each outlet designated on the plans shall be provided with an outlet box.

3.5 Each outlet box which supports a fixture shall be provided with a fixture stud into the outlet box. Outlet box and/or fixture stud shall be attached with not less than three screws or bolts.

3.6 Exterior outlets shall be provided with watertight gaskets and covers.

END OF SECTION 26 05 33

SECTION 26 05 45 - CONDUIT AND CONDUIT FITTINGS

PART 1 - GENERAL

1.1 Conduit shall be delivered to the project site in bundles of full-length pipes, each length marked with the trademark of the manufacturer and the Underwriters' Laboratories, Inc. stamp. Each conduit length shall be straight, true, and free from scales, blisters, burrs and other imperfections.

1.2 Within the building parameters and above the floor slab, the rigid steel conduit specified shall be used unless specifically noted otherwise.

1.3 Conduit size for control wiring shall be a minimum of one-half (1/2) inch conduit. All branch circuit conduit shall be a minimum of one-half (1/2) inch. Percent filled and derating shall be in accordance with the National Electrical Code. Flexible metal and water-tite ("sealtite") conduit in size 1/2” and larger shall be acceptable for motor, appliance, and fixture connections from fixture junction boxes or appliance/motor disconnects provided a ground wire is installed in the flex and the flex assembly is an integral part of the fixture, shipped from the same factory as the fixture, and 3rd party agency approved for such use. The third-party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to Label Electrical & Mechanical Equipment. This same requirement shall apply for motor/appliance connections.

1.4 All conduits shall be installed in accordance with the National Electrical Code.

1.5 Conduit shall be manufactured by Triangle, G.E., Cruse-Hinds, or equivalents.

1.6 Conduit fittings shall be manufactured by Rayco, T & B, Crouse Hinds, or equivalents.

1.7 Surface mounted raceway shall be used as noted on the plans in lieu of exposed conduit. Surface mounted raceway shall be manufactured by Wiremold or approved equivalents. A separate ground wire shall be run in the surface mounted raceway.

PART 2 - PRODUCT

2.1 Thin Wall Conduit and Fittings

A. Electrical metallic tubing (EMT) shall be cold-rolled steel tubing with zinc coating on the outside and protected on the inside by a zinc, enamel or equivalent corrosion-resistant coating conforming to the latest requirements of ANSI. Conduit shall meet the Rigid Conduit Association Standards.

B. Electrical metallic tubing fittings shall be all steel plated hexagonal threaded compression type. No pot metal, indenter, or set screw fittings, shall be used. EMT connectors shall have insulated throats.

2.2 Rigid Steel Conduit and Fittings

A. Rigid steel conduit, including elbows and nipples, shall be standard weight, mild steel pipe, hot dipped galvanized, sherardized or zinc-coated conforming to the requirements of ANSI C80.1, 1966 or later edition. Rigid steel conduit shall also meet the latest requirements of Underwriters' Laboratories, Inc. Standards for Rigid Metallic Conduit.

B. Fittings shall be all steel plated hexagonal threaded fitting.

2.3 Flexible Metal Conduit and Fittings

A. Flexible metal conduit shall be of the best grade interlocking spiral strip steel. The interlocking spiral strip construction shall be such as to permit bending of the conduit to a radius of four (4) times its internal diameter without distorting at any point. The interior and the exterior of the flexible conduit shall be smooth and free of burrs, sharp edges, or other defects which could damage the wire.

B. Fittings shall be of the approved types, made of malleable iron and hot dipped galvanized.

C. All connectors shall be steel compression fittings with insulated throats.

D. Where water tight flexible conduit is required, it shall have an outer sheath of material similar to PVC.

2.4 Non-metallic Conduit

A. Non-metallic conduit shall be UL listed, for its particular application. It shall be resistant to sunlight and chemical and moisture atmospheres, and rated for use with 90 degrees Celsius conductors.

B. The installation and usage of rigid non-metallic conduit shall comply with Article 347 of the National Electrical Code, along with any related or referenced sections.

PART 3 - EXECUTION

3.1 General

A. All conduit shall be run tight against walls, columns or ceilings.

B. The conduit shall bend cold 90 degrees about a radius equal to ten (10) times its own diameter without signs of flaw or fracture in either pipe or protective coverings. All bends and offsets shall be made on a forming tool to prevent the conduit or its coating from being damaged in the bending. Conduit bends shall have a radius not less than ten (10) times the conduit diameter.

C. Where conduits join any couplings or threaded fittings, the ends shall be made watertight. (All conduit runs, including boxes, couplings, and fittings used therein, shall be so installed and equipped as to prevent water from entering the conduit.)

D. All conduits shall be carefully cleaned before and after erection. After cleaning, all ends of conduits shall be free from burrs and inside surfaces shall be free from imperfections likely to injure the wires or cables.

E. In every instance, conduit shall be installed in such a manner that the conductors may readily and easily be drawn or pulled in without strain or damage to the insulation; and, also, so that defective conductors may be readily and easily withdrawn and replaced by new conductors. Long radius bends and a sufficient number of approved pull and junction boxes shall be approved for this purpose, and as may be directed by the Engineer. All conduit shall be securely supported and grounded.

F. In unfinished areas, exposed conduit shall be run to conform to the building lines with special emphasis on neatness. Turns shall be made with galvanized outlet boxes, junction boxes, factory fittings and/or symmetrical bends. Locknuts and bushings shall be employed to provide full grounding and adequate protection of insulation. Double locknuts shall be used on all conduits entering sheet metal enclosures.

G. Support for all conduit shall be in accordance with the National Electrical Code. Conduit shall be supported by approved pipe straps or clamps (conduits installed on the interior of exterior building walls shall be spaced off the wall surface a minimum of ¼ inch using “clamp-backs” or strut), secured by means of toggle bolts on hollow masonry; metal expansion shields and matching screws or standard pre-set inserts on concrete or solid masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction. Powder actuated fasteners are not allowed on State projects.

H. All empty conduit systems shall be capped or terminated in a junction box and shall be provided with nylon pull cord inside for future use.

I. Conduit terminating below grade shall be provided with means to prevent entry of dirt or moisture. Depth of burial shall not be less than two (2) feet below grade. All termination points shall be accurately marked and dimensioned on the As-Built Plans.

J. Where conduits of any type pass over a building expansion joint, a standard "expansion joint fitting" compatible with the type of raceway shall be provided.

K. Conduits installed on the interior of exterior building walls shall be spaced off the surface a minimum of 1/4” using “clamp-backs” or strut.

3.2 Thin Wall Conduit and Fittings

A. Except for service and feeder conduits, electrical metallic tubing and fittings may be installed in lieu of rigid conduit in dry construction in furred spaces, ceiling cavities, chase spaces, interior portions other than concrete and solid plaster, or for exposed work except on mechanical structure or supports.

B. Electrical metallic tubing shall not be installed.

1. Where exposed to severe corrosive conditions and/or severe physical damage,
2. Nearer than four (4) feet from finished floor in exposed areas
3. In trade sizes larger than two (2) inches

4. Located in exterior walls or in poured concrete.
5. Any location outdoors.
6. Where tubing, coupling, elbows and fittings would be in direct contact with the earth or underground (in/below slab-on-grade or in earth.

C. A transition between a run of rigid conduit concealed in a wall and a run of thin wall conduit along a ceiling shall be made in an outlet box above the ceiling, if accessible, near the wall.

3.3 Rigid Steel Conduit and Fittings

A. All conduit terminations shall be provided with insulating bushings.

B. Condulet fittings shall not be used in lieu of pull boxes.

C. Except where located under the ground floor slab, all service and feeder conduit shall be heavy wall (rigid galvanized).

D. Rigid steel conduit shall be installed in exterior masonry walls, in wet locations where subject to severe physical damage, or where conduit trade size is two and one half (2 1/2) inches or larger.

3.4 Flexible Metal Conduit and Fittings

A. Flexible metallic conduit shall be provided at the end of each conduit run terminating at the conduit box on electric motors, transformers or other equipment.

B. The length of flexible conduit shall be in accordance with the National Electric Code.

3.5 Non-Metallic Conduit

A. Thin wall rigid non-metallic conduit (schedule 40 PVC) shall only be used for concrete encasement.

B. Except where embedded in concrete, conduit shall be supported to permit adequate lineal movement to allow for expansion and contraction of conduit due to temperature change. Where a temperature change in excess of 14 degrees Celsius is anticipated, such as direct burial, exposed outside of the building, or in un-insulated spaces inside the building (attics, crawl spaces, etc.), expansion joints shall be installed in accordance with the manufacturer's specifications.

C. Heavy wall non-metallic conduit (schedule 80 PVC) shall be used where conduits are direct buried exterior to the building or exposed exterior to the building.

D. PVC schedule 40 shall not be used exposed or concealed in gypsum wall, but may be used in CMU walls. PVC schedule 40 may be used in elevated floor slabs and in foundation slabs. Minimum concrete cover shall be ¾ inch at finished or formed surface and shall be 3 inches at concrete surface cast against earth or for slabs placed on-grade. Greater amounts of concrete cover shall be used in areas subject to damage. The placement of conduit in floor slabs must be thoroughly coordinated with the structural design. Potential conflicts with steel reinforcing bars and reductions in net concrete sections are among the issues that must be considered by the structural engineer.

3.6 Underground Raceways

A. Where conduit is installed under the ground floor slab within the building foundations, schedule 40 PVC conduit shall be used. At the Contractor's option, this installation may consist of galvanized steel conduit encased with three (3) inches of concrete or rigid steel conduit with a minimum of 15 mils of PVC coating. Where thin wall non-metallic conduit is used under the ground floor slab, the elbows and turn out required to turn the raceway up into cabinets, equipment, boxes, etc. shall be of rigid steel.

B. Raceways run external to building foundation walls, with the exception of branch circuit raceways, shall be encased with a minimum of three (3) inches of concrete on all sides.

1. Encased raceways must have a minimum cover of eighteen (18) inches, except for raceways containing circuits with voltages above 1000 volts, which must have a minimum cover of thirty (30) inches.
2. Encased raceways shall be of a type approved by the NEC as "suitable for concrete encasement."

C. Branch circuit raceways run underground external to building foundation walls shall be run in raceways installed in accordance with the NEC and shall be of a type approved by the NEC as "suitable for direct burial." Minimum raceway size shall be 3/4 inch.

D. All underground raceways shall be identified by underground line marking tape located directly above the raceway at 6 to 8 inches below finished grade. Tape shall be permanent, bright-colored, continuous printed, plastic tape compounded for direct burial not less than 6 inches wide and 4 mils thick. Printed legend shall be indicative of general type of underground line below.

E. Raceways run underground internal to building foundation walls shall be of a type and installed by a method approved by the NEC.

F. Where underground raceways are required to turn up into cabinets, equipment, etc., and on to poles, the elbow required and the stub-up out of the slab or earth shall be of rigid steel.

G. The raceway system shall not be relied on for grounding continuity.

H. Where passing through a "below grade" wall from a conditioned interior building space, raceways shall be sealed utilizing fittings similar and equal to OZ/GEDNEY type "FSK" thru-wall fitting with "FSKA" membrane clamp adapter if required.

3.7 Duct bank

A. Excavation and backfill shall conform to "Division 2" of the specifications except heavy-duty, hydraulic-operated compaction equipment shall not be used.

B. Trenches should be cut neatly and uniformly, sloping uniformly to required pitch.

C. Ducts should be pitched to drain toward manholes and handholes and away from buildings and equipment. Minimum slope shall be 4 inches in 100 feet. Where necessary to achieve this between manholes, ducts should be sloped from a high point in the run to drain in both directions.

D. Concrete encased nonmetallic ducts shall be supported on plastic separators coordinated with duct size and spacing. Separators shall be spaced close enough to prevent sagging and deforming of ducts. Separators to the earth and to ducts should be secured to prevent floating during placement of concrete. Steel or tie wires should not be used in such a way as to form conductive or magnetic loops around ducts or duct groups.

E. Waterproof marking cord should be installed 130-pound tensile test (marked at least every foot), equivalent to Greenlee No. 435, in all ducts, including spares, after thoroughly rodding, clearing and swabbing all lines free of any and all obstructions.

F. All ducts should be sealed at terminations, using sealing compound and plugs, as required to withstand 15 psi minimum hydrostatic pressure.

G. The arrangement of conduit in duct bank should be in accordance with OSHA requirements.

END OF SECTION 26 05 45

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, transformers, switchboards, motor control centers and other electrical equipment supplied for the project.

1.2 Identify all disconnecting means in accordance with NEC 110.22(A).

1.3 Furnish and install self-adhesive plastic tape for all receptacle and wall switch cover plates indicating circuit numbers.

PART 2 - PRODUCT

2.1 Nameplates:

A. Nameplates shall remain legible. Embossed, self-adhesive plastic tape is not acceptable for marking equipment.

B. Name plates shall be laminated phenolic plastic with engraved letter. Letters shall be approximately 1/2-inch high except where resultant nameplate size exceeds equipment size. Nameplate lettering may be adjusted accordingly with approval of the Engineer.

C. Nameplate material colors shall be:

1. Blue surface with white core for 120/208-volts equipment.
2. Black surface with white core for 277/480-volts equipment.
3. Bright red surface with white core for all equipment related to fire alarm system.
4. Dark red (burgundy) surface with white core for all equipment related to security.
5. Green surface with white core for all equipment related to emergency systems.
6. Orange surface with white core for all equipment related to telephone systems.
7. Brown surface with white core for all equipment related to data systems.
8. White surface with black core for all equipment related to paging systems.
9. Purple surface with white core for all equipment related to TV systems.

D. Self-adhesive plastic tape:

1. All text shall be type written by the tape compatible equipment. No handwritten.

PART 3 - EXECUTION

3.1 Nameplates shall be securely attached to equipment using two-part epoxy adhesive suitable for location where installed. In outdoor locations, labels applied using two-part epoxy shall be weatherproof and sunlight resistant.

3.2 All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet.

3.3 All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This includes covers on boxes above lift-out and other type accessible ceilings, where identification shall also include branch circuit designation.

END OF SECTION 26 05 53

PART 1 - GENERAL

1.1 The Electrical Contractor shall provide dry type transformer(s) of the size and type as shown on the engineering plans.

1.2 Transformer(s) shall be manufactured by Square D or approved equivalents by General Electric, ITE, or Cutler-Hammer.

PART 2 - PRODUCT

2.1 Transformer(s) shall be 208-volt delta to 277/480-volt, three (3) phase, four (4) wire "Y" of the size(s) shown. Transformer(s) shall be energy efficiency type.

Three phase transformer efficiency shall be no less than the following table.

Transformer Rating (KVA)	Efficiency
15	97%
30	97.5%
45	97.7%
75	98%
112.5	98.2%
150	98.3%

2.2 Transformer shall be insulated with a 220 ºC temperature insulation system. Transformer shall be 115 ºC temperature rise and floor mounted with vibration isolation pads provided. Transformer shall be capable of carrying a 15% continuous overload, without exceeding a 150 ºC rise. Required performance shall be obtained without exceeding the above rise in a 40 ºC maximum, 30 ºC average ambient temperature. Where floor mounted units are suspended, the type of suspension and vibration isolation shall be as detailed on the plans.

2.3 Six 2 1/2% taps, two above and four below normal shall be provided.

2.4 Transformer winding shall be copper.

2.5 The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable Underwriters' Laboratory and National Electric Code standards.

2.6 The maximum temperature of the top of the enclosure shall not exceed 50 ºC rise above 40 ºC ambient.

PART 3 - EXECUTION

3.1 Transformer(s) shall be installed in accordance with manufacturer's instructions and in compliance with the National Electric Code.

3.2 Unit(s) shall be mounted on a 3 1/2" high concrete pad furnished by the Electrical Contractor. The pad shall be 2500 PSI concrete and the pad size shall be greater than the transformer(s) size by a minimum of 4".

3.3 Make connections to transformer(s) with a minimum of one (1) foot of flexible conduit.

END OF SECTION 262213

SECTION 26 24 16 - PANEL BOARDS AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 The Electrical Contractor shall provide all panelboards and circuit breakers as shown on the plans in accordance with this specification.

1.2 All equipment shall meet UL, NEC and NEMA Standards as applicable to the equipment specified herein.

1.3 All panelboards shall be equipped with a main circuit breaker or main lugs as indicated on the drawings.

1.4 All panelboards shall be equipped with branch breakers as shown on the drawings.

1.5 All panelboards identified on the drawings for use as service equipment shall be so labeled and UL listed for such use.

1.6 Full size insulated copper neutral bars shall be included in all panelboards. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

1.7 A copper ground bus shall be included in all panelboards.

1.8 All current-carrying parts of the bus assembly shall be copper with tin plating.

1.9 Panelboards shall be labeled with a UL short circuit rating not less than the rating indicated on the drawings.

1.10 The word "spare", unless noted otherwise on the panel schedules, shall be a single pole, 20-amp circuit breaker.

1.11 The word "space", unless noted otherwise on the panel schedules, shall be for a space in the panelboard for a standard size, single pole circuit breaker.

1.12 Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.

1.13 Sub fed breakers are not acceptable.

1.14 Series rated panel boards or breakers are not acceptable.

1.15 All NEMA 1 panel boards shall have a hinged trim (Door in Door).

1.16 All panelboards shall have breakers, terminals, and Lugs UL approved use with 75ºC rated conductors.

PART 2 - PRODUCT

2.1 This section shall be for panelboards whose characteristics shall not exceed the following:

Voltage	=	240	Maximum Branch Circuit	=	125 amps
Amps	=	600	Short Riding Circuit	=	22,000 amps

A. Panelboards shall be Square D Company type NQ (bolt- on) or equivalent by Siemens, Cutler-Hammer, or GE by ABB.

B. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.

C. The panelboard bus assembly shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA, UL and National Electrical Code requirements for panelboards. The box shall be fabricated from galvanized steel or equivalent rust-resistant steel. Surface mounted cans shall be galvanized and without preformed knockouts.

D. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Door shall be mounted by completely concealed steel hinges. A circuit directory frame with a clear plastic covering and a directory card shall be provided on the inside of the door. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish.

E. Panelboard trims shall cover all live parts. Switching device handles shall be accessible.

2.2 This section shall be for panelboards whose characteristics shall note exceed the following:

Voltage	=	480	Maximum Branch Circuit	=	125 amps
Amps	=	600	Short Circuit Rating	=	65,000 amps 480 VAC
				=	100,000 amps 240 VAC

A. Panelboards shall be Square D Company Type NF (bolt- on) or equivalent by ITE, Cutler-Hammer, or General Electric.

B. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.

C. The panelboard bus assembly shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA, UL and National Electrical Code requirements for panelboards. The box shall be fabricated from galvanized steel or equivalent

rust-resistant steel. Surface mounted cans shall be galvanized and without preformed knockouts.

D. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Door shall be mounted by completely concealed steel hinges. A circuit directory frame with a clear plastic covering and a directory card shall be provided on the inside of the door. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish.

E. Panelboard trims shall cover all live parts. Switching device handles shall be accessible

2.3 Molded Case Circuit Breakers

A. This specification covers molded case circuit breakers rated 15 through 1200 amperes 120VAC, 240VAC, 277VAC and 480VAC. Breakers covered under this specification may be installed in switchboards, panelboards, motor control centers, combination motor starters, busway plugs and individual enclosures.

B. Circuit breakers shall be manufactured by Square D Company of the size as indicated on the drawings or equivalent by Siemens or General Electric. All breakers shall be bolt-on type.

C. All circuit breakers shall have a quick-make, quick- break over center toggle type mechanism. The handle mechanism shall be trip-free to prevent holding contacts closed against a short circuit or sustained overload. All circuit breakers shall assume a position between on and off when tripped automatically. Multi- pole circuit breakers shall be common trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Arc extinction is to be accomplished by magnetic arc chutes. All ratings shall be clearly visible.

D. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Circuit breakers shall be calibrated to carry 100% rated current in an ambient of 40 degrees Celsius. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40 degrees Celsius, the circuit breaker automatically derates itself to better protect its associated conductor. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes 250 amps and above.

E. The interrupting rating of each circuit breaker shall be as indicated on the drawings. The interrupting rating of the circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to UL listed integrated short circuit current rating specified for the panelboards and switchboards.

F. UL Class A (5 milliampere sensitivity) ground fault circuit protection shall be provided on 120 V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional single pole circuit breaker.

G. Motor starters, and other applications as indicated on drawings, shall be furnished with magnetic-only type molded case circuit breakers. Each breaker shall be provided with a single magnetic adjustment that will set all poles to the same trip current. Adjustment shall be continuous throughout the adjustable trip range. The magnetic trips shall be accessible from the front of these circuit breakers.

PART 3 - EXECUTION

3.1 Panelboards shall be flush, or surface mounted as shown on the plans.

3.2 Panel enclosures shall not be used as junction or pull boxes for splicing conductors.

3.3 Each flush mounted panel shall be equipped with two empty one inch conduits sealed in the wall from a panel to a six inch square flush mounted box installed above a lay-in type ceiling or flush in the wall at the ceiling for a plaster or spline type acoustical tile ceiling.

3.4 All panels shall be equipped with neatly typed directory cards attached on the inside of the door.

3.5 GFI circuits shall be tested by the Contractor prior to the pre-final inspection.

3.6 Testing shall be performed by a qualified factory technician at the job site. All readings shall be tabulated by the contractor.

3.7 The number of branch circuit shall be identified with permanent wire tag attached to the wire.

3.8 Panelboards shall have a short-circuit current rating not less than the available fault current. The available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The label shall be of sufficient durability to withstand the environment involved.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 Switches, dimmer switches, photocell, contactors and receptacles, with proper cover plates, shall be provided where indicated on the Drawings.

PART 2 - PRODUCT

2.1 Switches, dimmer switches, photocell, contactors and receptacles shall be as specified in the Symbol Schedule of the Drawings.

2.2 All switches and receptacles shall be federal specification grade meeting NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL-498 and shall be approved third-party listed.

2.3 Switches and receptacles shall be as manufactured by Hubbell, Pass and Seymour, or Leviton. Photocells shall be manufactured by Tork, Paragon, Bryant, or equivalent.

2.4 Cover plates for all wall mounted devices shall be provided as scheduled on the Drawings. Where covers are not specified, they shall be as follow:

A. Interior: type 302 stainless steel. Cover plate mounting screws shall be slotted head oval screws and shall match the finish and material of the plate and shall be furnished with the plate by the plate manufacturer.

B. Exterior, exposed work and wet locations: cover plates shall be extra-duty rated (NEC 406.9(B)(1)) galvanized cast ferrous metal, standard size, and shall be single or ganged as indicated on the drawings. Exterior mounted switch and receptacle plates, and those noted to be weatherproof, shall be weatherproof cover plates, standard size, single or ganged as indicated on the drawings, and shall be "approved" third party listed as "rain-tight while in use."

2.5 All devices shall have a hex-head green grounding screw for use in connecting device to green grounding conductor run in the conduit system.

2.6 All GFI devices shall be the feed through type.

2.7 All standard duplex receptacles shall be 20-amp, 125 volt rated.

2.8 All devices subject to use in a wet location shall be listed as weather resistant.

2.9 All switches shall be rated 20-amp, 120/277 volt. Toggle switches shall have quiet operating mechanisms without the use of mercury switches.

2.10 Cord Reels shall have the following features:

A. Cast aluminum construction with swivel mounting base.

B. Listed to UL standard 355.

C. Hardwire input, 120 volt or 250 volt per notes on the plans.

D. Cord shall be fully rated 20 amp, SJO Cable, 12 AWG with ground. Minimum length 35 feet.

E. Provide with ball stop.

F. Output device shall be as indicated on the plans.

PART 3 - EXECUTION

3.1 Mounting height shall be as indicated on the Drawings. Coordinate with other trades so that devices will miss equipment installed by others.

3.2 Where two or more devices are ganged, they shall be in a common box with a ganged plate.

3.3 All devices shall have a green ground conductor to run parallel with the phase conductor back to the electrical panel.

3.4 In all areas where carpet is to be installed as finished floor material, unless otherwise specified, the Electrical Contractor will furnish solid brass carpet flanges for installation on floor outlet boxes. Flanges will be furnished and installed on all active outlets after the carpet is installed. Where a specified number of outlet fittings are to be furnished to the Owner, for each fitting not installed during the construction period, it will be turned over to the Owner with the receptacle, carpet flange and all necessary appurtenances.

3.5 All receptacles mounted above counters; backsplashes shall be mounted horizontally unless otherwise noted on plan.

3.6 Mount cord reels per approved methods to the structure.

3.7 Provide quantity of 2% spare cover plates of each type to the owner.

END OF SECTION 26 27 26

SECTION 26 27 27 – DISCONNECTS

PART 1 - GENERAL

1.1 Disconnect switches shall be provided where indicated on the drawings, or as required by the National Electrical Code (NEC).

PART 2 - PRODUCT

2.1 Disconnects shall be heavy duty as manufactured by Square D Company, Siemens, Cutler-Hammer, GE by ABB, or approved equivalent.

2.2 Disconnects shall be furnished with factory finish paint and appropriate knockouts for conduit connections.

2.3 All disconnects shall have side hinged type doors. Front operated handles will not be permitted.

2.4 All fused disconnects shall be equipped with positive pressure fuse clips and shall have visible disconnecting blade switches.

2.5 NEMA 1 enclosures shall be provided where installed indoors. NEMA 3R enclosures shall be provided where exposed to the elements, unless noted otherwise.

2.6 All disconnects shall have copper bus.

2.7 Disconnects shall have provisions for locking in on and off positions.

2.8 Disconnects shall have defeatable door interlocks that prevent the door from opening when the operating handles is in the “on” position.

2.9 Disconnects shall have handles whose positions are easily recognizable in the “on” or “off” position. For safety reasons, padlock shall be provided for switches located in the public areas.

PART 3 - EXECUTION

3.1 Disconnect switches shall be mounted as indicated on the Drawings and shall be independently supported. Conduits entering the disconnect switch shall not be used to support switches.

3.2 Where fused disconnect switches are required or shown on the plans, standard Fusetron fuses shall be used unless the switch protects an individual motor circuit, then dual element Fusetron fuses shall be used.

3.3 The electrical contractor shall provide to the owner the spare fuses, 10% of the quantity of fuses used of each type and rating, with a minimum of one set of each type.

END OF SECTION 26 27 27

SECTION 26 51 00 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 The Contractor shall provide all fixtures and lamps where indicated on the Drawings.

1.2 Work shall include all stems, canopies and accessories necessary for a complete lighting fixture installation.

1.3 No PCB ballasts shall be accepted.

1.4 All lighting systems shall comply with the 2018 North Carolina State Energy Code and North Carolina Senate Bill 1946 and G.S. 143-64.17.

PART 2 - PRODUCT

2.1 Fixtures shall be as specified in the Fixture Schedule on the Drawings or approved equivalents.

2.2 All outdoor fixtures shall bear the approved third-party test label for damp or wet locations as applicable. Where the ambient falls below 50ºF that all fluorescent lamps and ballasts shall be rated for operation at 0ºF.

2.3 Unless otherwise noted, all fixtures shall be new, free of defects and imperfections. Damaged fixtures shall be replaced at this Contractor's expense.

2.4 All acrylic lenses for lay-in troffers and wrap around fixtures shall have a nominal lens thickness of 0.125” unless noted otherwise on plans.

2.5 LED Luminaries:

A. LED driver manufacturers should have a minimum of five years of experience with the manufacture of LED drivers. All drivers shall have a minimum warranty of five years.

B. Where dimming is required, fixtures shall be dimmable down to 1% with standard 120/277-volt, electronic, low voltage dimmers.

C. Minimum color rendering index (CRI) shall be 80. Color temperature and performance shall conform to the parameters established by ENERGY STAR SSL standards (refer to ANSI-C78.377-2008).

D. Optical design shall be low glare, 50% cut-off.

E. Rated for 50,000 hours at 70% lumen maintenance.

F. LED driver shall be high efficiency with a minimum power factor of .90

G. 5 years, 100% warranty coverage for the driver, LED module, housing and trim. For the 1st year this shall be a complete parts and labor warranty. The 4th and 5th years shall cover parts only.

H. Total harmonic distortion: ≤ 20% (at full luminaire output and across specified voltage range)

I. Transient and surge protection: ANSI C62.41-2002 Category A surge protection standards up to and including 2.5 kV for interior fixtures.

J. Sound: Class A not to exceed a measured value of 24dB.

K. Maximum standby power: 1W

L. LED arrays in the product(s) will be considered defective in material or workmanship if a total of 10% or more of the individual light-emitting diodes in the product(s) fail to illuminate during normal operation after installation.

2.6 Emergency Exit Signs requirements.

It shall be completely self-contained, provided with maintenance-free battery, automatic charger, and other features. Luminaire must be third-party listed as emergency lighting equipment, and meet or exceed the following standards; NEC, N.C. Building Code, Energy Code, NFPA-101, and NEMA Standards.

A. Battery

It shall be sealed, maintenance-free type, with minimum of 90 minutes operating endurance. Must have a normal life expectancy of 10 years. Batteries shall be a high temperature type with an operating range of 0 degree C to 60 degrees C and contain a resealable pressure vent, a sintered + positive terminal and – negative terminal.

B. Charger

It shall be fully automatic solid-state type, full wave rectifying, with current limiting. Charger shall restore the battery to its full charge within 24 hours after a discharge of 90 minutes under full rated load. The unit shall be activated when the voltage drops below 80 percent. A low voltage disconnect switch shall be included if LEAD Battery is used, to disconnect the battery from the load and prevent damage from a deep discharge during extended power outage.

C. Additional Features

Pilot light to indicate the unit is connected to AC power. The battery shall have high rate charge pilot light, unless self-diagnostic type. A test switch to simulate the operation of the unit upon loss of AC power by energizing the lamps from the battery. This simulation must also exercise the transfer rely.

D. Warranty

The entire unit shall be warranted for three years. The battery must have an additional two more years pro-rated warranty. Warranty shall start from the date of project final acceptance. Warranty shall be included in the contract document.

E. LED

The use of LED is required due to their reliable performance, low power consumption, and limited maintenance requirements. Maximum LED failure rate shall be 25% within a seven (7) year period; otherwise, if exceeded, manufacturer shall replace the complete unit at no charge to the owner.

F. Unit Test

Contractor shall perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes, in accordance with NEC 700. The battery test shall be done 10 days prior to final inspection by the State Construction Office. Any unit which fails the test must be repaired or replaced and tested again. Copy of the test report shall be included with the project record documentation.

2.7 Emergency Lights requirements

Shall be completely self-contained, provided with maintenance-free 12-volt battery, automatic charger, two lamps and other features. Fixture shall be third party listed as emergency lighting equipment, and meet or exceed the following standards: NEC, N.C. Building Code, UL 924, NC Energy Code, NFPA-101, and NEMA Standards.

A. Additional Features

Pilot light to indicate the unit is connected to AC power. The battery shall have high rate charge pilot light, unless self-diagnostic type. A test switch to simulate the operation of the unit upon loss of AC power by energizing the lamps from the battery. This simulation must also exercise the transfer rely. If fluorescent emergency unit is used, a LED charging indicator light must be easily visible after installation and a remote test switch shall be installed adjacent to the fixture.

B. Battery

It shall be sealed, maintenance-free type, with minimum of 90 minutes operating endurance. Must have a normal life expectancy of 10 years. Batteries shall be a high temperature type with an operating range of 0 degrees C to 60 degrees C and contain a resealable pressure vent, a sintered + positive and –negative terminal.

C. Charger

It shall be fully automatic sold state type, full wave rectifying, with current limiting. Charger shall restore the battery to its full charge within 24 hours after a discharge of 90 minutes under full rated load. The unit shall be activated when the voltage drops below 80%. A low voltage disconnect switch shall be included in LEAD battery is used, to disconnect the battery from the load and prevent damage from a deep discharge during extended power outage.

D. Warranty

The entire unit shall be warranted for three years. The battery must have an additional two more years pro-rated warranty. Warranty shall start from the date of project final acceptance. Warranty shall be included in the contact document.

E. Unit Test

Contractor shall perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes, in accordance with NEC 700. The battery test shall be done 10 days prior to final inspection by the State Construction Office. Any unit which fails the test must be repaired or replaced and tested again. Copy of the test report shall be included with the project record documentation.

2.8 Emergency Power Backup unit.

The unit is used for controlling designated light fixtures as shown on plan to be used as emergency light. The unit shall have rating as shown on plan. Unit shall be third party listed as emergency power backup unit for emergency light, and meet or exceed the following standards: NEC, N.C. Building Code, UL 924, NC Energy Code, NFPA-101, and NEMA Standards.

A. Battery

It shall be sealed, maintenance-free type, with minimum of 90 minutes operating endurance. Must have a normal life expectancy of 10 years. Batteries shall be a high temperature type with an operating range of 0 degree C to 60 degrees C and contain a resealable pressure vent, a sintered + positive terminal and – negative terminal.

B. Output characteristic.

It shall provide 60Hz sinusoidal waveform output and compatible with LED and fluorescent light fixtures. Transfer time shall be less than 1 second.

C. Warranty

The entire unit shall be warranted for three years. The battery must have an additional two more years pro-rated warranty. Warranty shall start from the date of project final acceptance. Warranty shall be included in the contact document.

PART 3 - EXECUTION

3.1 All fixtures shall be installed in accordance with the National Electric Code.

3.2 All fixtures other than the lay-in type shall be individually supported from building structure with 1/4" threaded rods and nuts.

3.3 Where a recessed or downlight fixture replaces a section or part of a ceiling tile, fixture is to be supported at the two (2) opposite ends to the steel frame of the building. Supports shall be provided with the same type of wire as used to support the lay-in ceiling track. Attach one end of the wire to one corner of the luminaire and the other end to the building's structural system.

The lay-in luminaire shall then be screwed to the main runners of the lay-in ceiling track at all four (4) corners using sheet metal screws. For fire rated suspended ceiling, luminaire shall be supported to the Building Structure as per the Ceiling Design Criteria, luminaire shall then be screwed to the main runners of the suspended ceiling track at all four (4) corners using sheet metal screws.

3.4 The complete emergency lighting system shall be tested by throwing the circuit breakers feeding the emergency lighting circuits. One and one-half hours thereafter, the battery voltages shall be recorded in a report to be submitted to the Engineer. This test shall be performed just prior to final inspection, under witness of the state electrical inspector, and in accordance with NEC Articles 700.4 (A) and (D).

END OF SECTION 26 51 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The Contractor shall provide the required protection in accordance with the requirements of these specifications and NEC 2020, Article 800. The protection shall be provided on both ends of all inter-building cables where required by code or otherwise indicated in the contract documents (i.e., building-to-building, building-to-modular classroom, or building-to-modular complex).

1.2 SUMMARY

A. This Section includes a Telecommunications Distribution System which is ready for the installation of active electronic equipment such as hubs, routers, bridges, switches, repeaters, adapters, etc. The system shall incorporate all requirements of this specification.

1.3 CONTRACTOR DELIVERABLES

A. The contractor will need to coordinate the installation of the telecommunications cabling with the general contractor. Cable shall not be installed until the building is secured.

B. The Contractor shall prepare and provide two (2) copies of the following documentation for review and approval by the Engineer:

1. A labeled cable plant drawing.
2. Work Area Floor Plans - Include detailed cable routes and labeling plan for all work areas. The Contractor may obtain floor plans from the Architect in AutoCAD format, if so desired, to aid in preparing the submittal.

C. Upon completion of the project, the Contractor shall prepare "As-Built" documentation showing actual site conditions and installation as constructed, and provide copies of such documentation as per paragraph A.3.b.

D. In addition to the engineering diagrams, the following items shall be provided by the Contractor <u>at substantial completion</u>:

1. Laminated cable schedule, sized 8-1/2 “x 11”.
2. Record of field tests of System

    a. The data TCO identification numbers in recording test results shall be the same as those shown on the “As-Builts” and cable schedules.

E. Technical Support Staff and Experience

1. The Contractor shall provide a list of its project management staff and technical support staff to be assigned to this project together with their resumes and working experience.
2. The Contractor shall utilize certified cable installers and technicians with approved vendor specific certification. The Contractor shall supply certification documentation for cable installers.
3. The Contractor shall state their nearest branch office and dealer's office in relation to the proposed site of the cabling system. If none, the location of the main office shall be stated.
4. The Contractor shall state their nearest location of their principal support center. This center shall have permanently stationed support staff that is capable of providing technical support if required.

F. System Warranty

1. The Contractor shall provide a five- (5) year warranty for both products and labor.
2. Service must be provided within twenty-four (24) hours of notification for emergency situations and within seventy-two (72) hours for routine service.

1.4 PRODUCT SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

1. Product data for system components

1.5 QUALITY ASSURANCE

A. Comply as applicable with ANSI/TIA/EIA-568-B.1, ANSI/TIA/EIA-568-B.2, and ANSI/TIA/EIA-568-B.3 "Commercial Building Telecommunications Cabling Standard," most recent addition.

B. Comply as applicable with ANSI/TIA/EIA-569-A, "Commercial Building Standards for Telecommunications Pathways and Spaces," most recent addition.

C. Comply as applicable with ANSI/TIA/EIA-606, "The Administration Standard for Telecommunications Infrastructure of Commercial Buildings," most recent addition.

D. Comply with NFPA 70, "National Electrical Code," 2020.

E. NC STS-1000 Telecommuications Wiring Guidelines.

F. "Nationally Recognized Testing Laboratory" (NRTL) Listing: Provide materials that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
3. FCC Regulations: Comply with FCC Part 68, Chapter 1, "US Code of Federal Regulations," Title 47 for all telephone system wire and cable connection components.

PART 2 - PRODUCTS

2.1 BACKBONE CABLE: Contractor shall provide all backbone cable inside building.

A. FIBER OPTIC CABLE

1. All cables shall conform to or exceed the TIA/EIA-568-B.3 Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard.
2. The multi core optical fiber shall consist of multimode 50 micron fibers, OM4.
3. The fiber cable shall meet the NEC requirements for OFN, OFNR or OFNP and comply with Bellcore, FDDI, TIA/EIA-568-B.3 and ICEA standards.
4. Connectors shall be crimp-on type, pre-polished LC connectors or hot melt.

B. CATEGORY 3 COPPER VOICE

1. Contractor shall supply unshielded 24 AWG solid conductor multi-pair copper cables as the backbone cables.
2. The cable shall meet or exceed the TIA/EIA-568-B.2 “Commercial Building Telecommunications Cabling Standard” - Part 2: Balanced Twisted Pair Cabling Components.
3. The PVC sheath shall have improved frictional properties, allowing it to be pulled through conduit without the use of lubricants.
4. The cable shall be available in the form of twenty-five (25), fifty (50), one hundred (100), one hundred fifty (150), and two hundred (200) pairs.

2.2 HORIZONTAL CABLE: Contractor shall provide all horizontal cables.

A. CATEGORY CABLE (CAT6A)

1. All cables shall conform to or exceed the TIA/EIA-568-C
2. Other standards supported include IEEE 802.3, 10BASE-T, and ANSI X3T9.5 TP-PMD requirements for UTP at 100 Mbps.
3. Cables shall be capable of supporting evolving high-end applications such as 1000 Mbps ATM. All cables shall be composed of 4-pair 23 AWG solid copper conductors.
4. The cable shall be Underwriter’s Laboratories Inc. (UL) listed type MPR, MPP, CMR, and CMP.
5. Cable shall be plenum rated.

B. CATV COAXIAL: Horizontal CATV drop

1. 75 OHM COAXIAL
2. Cable shall be plenum rated.

2.3 TELECOMMUNICATIONS OUTLET (TCO)

A. Shall be modular, RJ45 type/8 position/8 conductor.

B. Shall be universal application/multivendor supportive accepting most phone and data plugs.

C. Modular connectors shall be flush with outlet faceplate.

D. Cover to match those indicated for power receptacle outlets in same spaces for materials and finish.

E. Outlets shall be wired in an EIA/TIA 568B configuration.

F. All outlets shall be listed for CAT6A application and utilize cross-over lead technology to address data circuit applications up to 100 MHz and conform to or exceed the EIA/TIA 568-C Commercial Building Telecommunications Wiring Standard and the following:

2.4 PATCH PANEL

A. FIBER OPTIC PATCH PANEL

1. The panel shall support shall be with LC connectors.

B. CAT6A PATCH PANEL

1. The panel shall support the Category 6A applications and facilitate cross-connection and inter-connection using patch cords.
2. The wiring blocks shall be fire-retardant, molded plastic consisting of horizontal index strips for terminating conductors. These index strips shall be marked with four colors on the high teeth, separating the tip and ring of each pair, to establish pair location.
3. The panel shall be able to accommodate over 500 repeated insertions without incurring permanent deformation and it shall pass the reliability test of no more than one contact failure in 10000 connections.
4. 19" rack mountable patch panels shall be used. Patch panel installations shall contain a retaining trough between every 100 pair termination block.
5. The panel shall be able to accommodate 23 AWG cable conductors.
6. The panel shall be Underwriter's Laboratories (UL) listed.
7. Shall be wired in an EIA/TIA 568B configuration.
8. All Category 6A patch panels shall support 100 Mbps TP-PMD and 155 Mbps ATM. All hardware shall meet or exceed the reliability, attenuation, and NEXT requirements of EIA/TIA 568A-5.

C. CATV PATCH PANEL

1. F TYPE connectors.

2.5 19 INCH FREE STANDING RACK

A. Hubbell HPW84RR19 or equal by Belden, APC, or Panduit.

B. Provide 2 post cable management rack. The rack must provide a space on both sides for cable management.

1. Front Horizontal wire management: Panduit CNMPHh2 or equal by Belden, APC, or Hubbell.
2. Rear Horizontal wire management: Panduit WMPHF2E or equal by Belden, APC, or Hubbell.
3. Wire management bracket: OCC VCM6 or equal by Beldin, APC, Panduit, or Hubbell.

C. Unit to be open steel configuration. Unit shall be heavy-duty construction and be mounted on floor.

D. Unit to be self-supporting.

E. Unit to be fully compatible with EIA 1 ¼" – ½" alternating hole patterns.

F. Provide clear finish over surface to inhibit oxidation.

G. Unit to be with one power strip. Power strip/surge with minimum of 15 ft. cord and LED ampere indicator. Power strip/surge protectors shall be delivered to the IT project manager.

2.6 CABLE TRAY:

A. Cable tray shall be tubular stringer style Eaton B-LINE: SB-17 or equal by Panduit, Hubbell, APC, or Belden.

B. With of tray shall be 12".

2.7 TERMINATION LABELS

A. Shall conform to ANSI/TIA/EIA-606. Labels will have pressure sensitive, permanent acrylic type adhesive, P-Touch type weatherproof or equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Contractor shall maintain conductor polarity (tip and ring) identification at the MDF and station connecting blocks in accordance with industry practices.

B. The Contractor shall provide all cables. All communication cable installed by the Contractor shall be fully tested in accordance with TIA-568-C series standard prior to acceptance.

C. The Contractor shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, wiring duct (MDF & IDF locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System in a neat and orderly fashion as approved by the Engineer.

D. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.

E. The Contractor shall be responsible for printed labels for all cables and cords to the specifications. No labels are to be written by hand including numbers on boots. Approval must be obtained from the engineer for labeling devices used.

F. The Contractor shall not place or attach any telecommunications cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.

G. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

H. The Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and insuring proper bonding. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes and framework. All grounds and bonding shall consist of green #6 AWG solid copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground.

I. The Contractor shall furnish to the Owner all closeout documentation in a three-ring binder with proper labeling on cover and the end of the binder.

3.2 INSTALLATION, GENERAL

A. Distribution System: The contractor is responsible for the back to the new communications closet.

B. Raceway: Install service and distribution raceway for all cabling as indicated.

C. Conduit sleeves for Computer Network Infrastructure shall be installed not more than four inches (4") from wall and shall be stubbed at a maximum of four inches (4") above or below finished floor. Plastic bushings and pull wires shall be provided.

3.3 HORIZONTAL CABLE INSTALLATION

A. Obtain approval of all raceway system installation from engineer prior to installing any cable. Install cable without damaging conductors or jacket. Do not bend cable to a smaller radius than minimum recommended by manufacturer. Do not exceed manufacturers recommended pulling tensions. Pull cables simultaneously where more than one is being installed in the same raceway or at the same location. Use pulling compound or lubricant where necessary. Compound used must not damage conductor or insulation. Use pulling methods that will not damage cable or raceway, including fish tape, cable, rope and wire-cable grips.

B. Wiring Method

1. New Construction: Install outlet boxes at outlets. Install cable in raceway in wall. Terminate raceway with a bushing in ceiling space above nearest cable tray. Run cable in cable tray in accessible ceiling space.
2. Provide bushings on all conduits stubbed to ceiling void.
3. Copper Cable above finished ceilings:

    a. Splices: Do not splice cable between the normal terminations of runs.

C. The 4-pair UTP cables shall be installed using a star topology format from the administration subsystem on each floor to every individual TCO.

D. The length of any horizontal Cat 6A cable shall not exceed 295-ft (90 m).

E. Cabling in Telecommunications closets and Cabinets: Install conductors parallel to and at right angles to walls. Final Termination by contractor.

3.4 TELECOMMUNICATION OUTLET (TCO)

A. Unless otherwise noted on the floor plans, the TCO shall be flush mounted.

B. Outlet jacks provided by contractor.

3.5 GROUNDING

A. Communications Systems - In compliance with NEC 2020, Article 800.

1. See plan for detail.

B. Contractor shall install a copper busbar at the new telecommunication board for grounding of communication systems.

3.6 IDENTIFICATION

A. Provide identification in accordance with the recommendations of ANSI/TIA/EIA-606-B, "Administration Standard for Telecommunications Infrastructure." Refer to labeling descriptions below.

B. New labeling shall be a fully integrated extension of the existing network labeling system. No duplication of the existing network nomenclature may be used in the new labeling system.

C. Buildings and Rooms

BuildingIDs and room numbers are assigned by the owner. The Designer and Contractor should check with the college project manager to ensure the proper building ID and room numbers are used when labeling communications systems components.

D. Racks

Racks in TRs shall be labeled based depending on their use. VoIP (1), Data (2), Security (3), and Miscellaneous (4). The label shall be machine generated, at least 1.5" high and have black letters on a white background. The label shall be plastic or vinyl and adhered to the center of the rack if possible.

E. Risers

All riser communications cabling such as Category 6a, Single Mode OS2 Fiber, Multi-mode 50 Micron OM3 Fiber, Multi-pair Category 3 telephone riser, and .500" Coax trunk shall be labeled on each end. This is to include originating and terminating Telecom room information, individual fiber strand, telephone pair, and Cat 6a copper riser patch panel port information. Riser patch panel labeling shall be consecutive.

F. Fiber Optic Cabling and Systems

Fiber optic cables and segments have a long lifespan at the college and must conform to college labeling requirements to support identification and computerized management systems already in place.

1. Fiber Cables

   a. Naming
   A fiber cable is a jacketed set of fiber optic cables, themselves generally enclosed in buffer tubes. Fiber cables are routed between buildings on a campus and enclosed in fiber enclosures. These enclosures will be labeled to indicate where the fiber cable is terminated. Within each module of the enclosure individual fibers with be identified with a sequential index based on the color code.

2. Patch Panels

   a. Naming
   Patch panels are assigned an ID based on the room number (205), rack (VoIP,1) and location in rack (A thru J)

3. Labeling

a. All patch panels shall be labeled to indicate the patch panel name. Labels shall be machine-generated, high contrast and between 1/2” and 1” high.

G. Copper Data Cabling and Systems

a. Labeling
All cable shall be labeled both at the outlet and the patch panel with an alpha/numeric identification code using the following format: The patch panel will point to the room (237) and the outlet location the cable terminates in (10) is: 237.10. The outlet 10 in room 237 will point to the IDF room number (239) and rack ID (1) and patch panel location (D) and port (23) i.e.: 239.1.D.23 .

b. Voice Cabling and Systems
For Fire Alarm lines “Room FA-1 /Room FA-2”, for Elevator phones “Room Elev 1 / Room Elev 2”, and for Emergency phones “Room Emer 1 /Room Emer 2”.

3.7 FIELD QUALITY CONTROL

A. Test Notice: Provide at least 10 days' notice in writing when the system is ready for final acceptance testing.

B. Acceptance Tests: Include the following for each pair or conductor of each cable run.

1. 100 percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.
2. Data horizontal wiring pairs shall be tested from the TCO to the patch panel or block, the basic link test.

C. Data cables shall be tested for conformance to the specifications of TIA/EIA -568-B.2.10 for Cat6a copper cable.

1. Wire Mapping shall be done to ensure proper wiring and connectivity. Test for:

a. Continuity, end-to-end.
b. Shorts between any two or more conductors.
c. Crossed pairs
d. Reversed pairs
e. Split pairs
f. Other mis-wirings
g. Document as Pass / Fail

2. Length shall be measured. Indicate the length of the cable as the pair with the shortest length and record it
3. Attenuation shall be tested with a remote signal injector and a reading made at the local end. Evaluate the worst pair attenuation and record result on test report.
4. Bi-Directional NEXT. Near-end crosstalk (NEXT) shall be tested on all six pair combinations in each four pair cable. Tests for NEXT shall be performed from both the work area outlet location and link origination point.

5. Computer generated test results must be submitted to the Architect.

D. Re-testing: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify that the total system meets the Specifications and complies with applicable standards.

E. Report of Tests and Inspections: Prepare a written record of inspections, tests, and detailed test results in the form of a test log and format the log in cable ID number order.

END OF SECTION 271000

PART 1 - GENERAL

1.1 This document includes the furnishing, installation, and connection of the microprocessor controlled; intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring.

1.2 The fire alarm system shall comply with applicable provisions of the NC Building Code, NFPA 70 - National Electrical Code (NEC), NC Fire Code, and NFPA 72 -National Fire Alarm and Signaling Code. The Contractor shall furnish all parts, materials, and labor customarily required or provided for a complete and operating system, in accordance with all requirements applicable, even if each needed item is not specifically shown or described in the project plans or specifications.

1.3 Systems are to be provided with a separate and independent source of secondary power. All systems that report to a Central or Remote Supervising Station shall have a minimum of 60 hours battery power capacity, plus 5 minutes of full alarm load.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products are Listed and Labeled. Products of firms that do not maintain factory authorized service organization and spare parts stock are not acceptable for use

B. Acceptable Manufacturers: Simplex, EST, Siemens, FireLite, Notifier or other approved equivalents.

C. Installer’s Qualifications: Company specializing in performing the work and making the final terminations and connections. Minimum of 5 years documented experience installing fire detection and alarm systems similar in size and scope to the project. Only the Installer may make program changes and must be present for the 100% test, Designer’s pre-final review and Owner inspections.

D. All connections to the FACP and the system's programming shall be done only by the manufacturer, or by an authorized distributor that stocks a full complement of spare parts for the system. The technicians are required to be trained and individually certified by the manufacturer, for the FACP model/series being installed. This training and certification must have occurred within the most recent 24 months, except that a NICET Level III certification will extend this to 36 months. Copies of the certifications must be part of the Shop Drawing submittal to the Designers, prior to installation. The submittal cannot be approved without this information.

E. The person that programmed the system must be present for the Engineer’s (and State Construction Office, as applicable for state projects) final inspection.

F. NFPA Compliance: Comply with applicable requirements of NFPA-72, National Fire Alarm and Signaling Code.

G. NEC Compliance: Comply with applicable requirements of NFPA-70, National Electrical Code (NEC) standards pertaining to fire alarm systems.

H. Comply with applicable requirements of NC Building Code and NC Fire Code.

I. Testing Laboratory Compliance: Comply with provisions of UL safety standards pertaining to fire alarm systems. Provide products and components which are Listed and Labeled.

J. FM Compliance: Provide fire alarm systems and accessories which are FM approved.

1.5 Definitions:

A. Authority Having Jurisdiction (AHJ).

1. The AHJ for code compliance is the Beaufort County Fire Marshal. The contractor shall field coordinate all permits and site inspections with the AHJ.

B. Fire Alarm Control Panel (FACP) - Also called a Fire Alarm Control Unit (FACU) by some entities. See requirements in Part B.

C. Remote Annunciator (FAA) – Provides LCD display with a text statement of the panel status and/or LED lamps to indicate the status of the fire alarm system. It is provided to assist fire fighters who respond to a call and to assist technicians who respond to a trouble condition.

D. Graphic Annunciator (GA) – Used to provide information regarding the status of detection, sprinkler and supervisor devices by zone and or floor of the building.

1.6 Submittals

A. Submittals shall address interface with other significant electrical subsystems (e.g. electrically controlled smoke dampers, door holders, smoke evacuation and smoke control systems, security lock door hardware, etc.).

B. Shop Drawings:

1. The fire alarm contractor shall submit complete Shop Drawings to the engineer for review, prior to performing any work. They shall clearly demonstrate compliance with the engineer’s plans and specifications, which have a System Response Matrix showing the fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal. Any non-compliant features must be fully described. Shop drawing submittals shall provide mA draw for each device submitted and the listed minimum voltage required to operate. Panel submittal shall list voltage drop allowed for panel and for individual NAC circuits.
2. The submitted shop drawings shall show equipment, device identification numbers and locations, and connecting wiring of entire fire alarm system. Include wiring and riser diagrams. Wiring diagrams shall be based on the project floor plans, with devices and

proposed conduit routing. The conductor composition for each conduit section shall be provided. The distance and route for each NAC (Notification Appliance Circuit) shall be shown. Riser diagrams shall show consecutive connections for all devices with addresses and candela and Candela ratings.

3. Engineer’s approval (with or without corrections) of contractor’s Shop Drawings, samples, cut sheets, etc., is for general conformance with the contract documents and design concept. It shall not relieve the contractor of responsibility for full compliance with the project plans and specifications, EXCEPT for any specific non-compliant features for which the engineer gives written authorization.
4. Installation Instructions: The contractor shall submit to the engineer of record the Manufacturer's detailed installation instruction for the Fire Alarm Control Panel and all duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.
5. Battery and Voltage Drop Calculations:

    a. Include a copy of system battery sizing calculations with the shop drawing submittal to the engineer. Use manufacturer's battery discharge curve to determine expected battery voltage after 60 hours of providing standby power. Then use calculated Notification Appliance Circuit current draw in the alarm mode to determine expected voltage drop at End of the Line Resistor (EOL), based on conductor resistance per conductor manufacturer's data sheet or NEC.
    b. Fire Alarm Vendor’s calculations must be submitted with the shop drawings, and prior to installation of equipment. (Buildings without generators require minimum 60 hours of battery backup to cover the weekends and major power outages. Buildings with generators require minimum 24-hour battery backup.) In the submittal package identify Notification Appliance Circuits (NAC) current draws and voltage drops for each circuit. Vendor must utilize the “end offline” method for voltage drop calculations. The “mid-point” method is not acceptable. In no case shall the calculated voltage at any notification appliance fall below the minimum listed operating voltage for the devices used.
    c. The voltage drop at EOL must not exceed 14% of the expected battery voltage, after the required standby time plus alarm time. (Typically, for a 24-volt system, this limits the voltage drop from the battery to the EOL to 3 volts). Determine "worst case" voltage at far end of each NAC, by subtracting its calculated V-drop from the expected battery voltage. The result must be no less than the minimum listed operating voltage for the alarm notification appliances used. All these calculations must be placed on a dedicated sheet of as-built drawings, for future reference by fire alarm service technicians.
    d. Provide copies of battery and voltage drop calculations at final inspection.

C. Maintenance Data: The contractor shall submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual.

D. Maintenance Contract: The contractor shall submit a quote for a maintenance contract to provide all maintenance, test, and repair described below and/or in accordance with NFPA-72, "Guide for Testing Protection Signaling Systems". Include also a quote for unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment, and response travel costs. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of two (2) years after expiration of the guaranty. Maintenance and testing shall be on a semiannual basis or as required whichever is the most restrictive. A

preventive maintenance schedule shall be provided by the Contractor that shall describe the protocol for preventive maintenance. The schedule shall include:

1. Inspection and testing of the fire alarm system in accordance with the requirements of NFPA 72 Chapter 14

E. Certifications:

1. Submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses, and telephone numbers in the certification.
2. Installer's training certificate as defined under Quality Assurance.

PART 2 - PRODUCT

2.1 FIRE ALARM CONTROL PANEL (FACP)

A. FACP - General: The FACP shall meet the following general requirements (unless otherwise required by the owner for certain systems):

1. The system is to be the addressable type, with a 24vdc nominal operating voltage.
2. The system is to have multiple access levels so owner's authorized personnel can disable individual alarm inputs or normal system responses (outputs) for alarms, without changing the system's executive programming or affecting operation of the rest of the system. The process on how to do this must be included in the training required to be given to the owner's designated personnel, and must also be part of the written documentation provided by the fire alarm equipment supplier.
3. Signal Line Circuits: (SLC) also called addressable loop - Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto an NFPA Style 6 (Class A) Signaling Line Circuit (SLC) with no "T" taps.
4. Initiation Device Circuits: Initiation Device Circuits (IDC) shall be wired Class A (NFPA 72 Style D).
5. Notification Appliance Circuits: Notification appliance circuits shall be wired Class B (NFPA 72 Style Y).
6. Digitized electronic signals shall employ check digits or multiple polling. In general, a single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
7. Loss of Power: Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
8. The FACP must have an Alarm Silence switch and be equipped with the Subsequent Alarm (alarm resound) feature. Any remote annunciators or graphic displays located away from the alarm area must also include an audible signal with alarm resound feature.
9. FACP - Minimum Requirements: The FACP shall contain a microprocessor based Central Processing Unit (CPU). The CPU and its associated equipment shall be protected so it cannot be affected by voltage surges or line transients consistent with UL standard 864. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, local and remote operator

terminals, printers, annunciators, and other system-controlled devices. The main FACP shall perform the following functions:

a. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
b. Supervise all initiating, signaling, and notification circuits throughout the facility by way of connection to monitor and control modules, or end of line resistor.
c. Visually and audibly annunciate any trouble, supervisory or alarm condition on operator's terminals, panel display, and annunciators.

B. System Response to an Alarm Condition: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

1. The system alarm LED shall flash.
1. A local piezo-electric signal in the control panel shall sound.
2. An 80-character minimum LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
3. On systems equipped with a printer, printing and history storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
4. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated. Exact programming shall be provided by the Contractor to meet the Owner’s requirements.
5. Detect activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
6. Activate all fire alarm Notification Appliances in the building, sounding and flashing in synchronization continuously until the initiating device and control unit have been reset to normal condition.
7. Activate digital alarm communicator.
8. Deactivate door hold control relay such that all smoke doors are allowed to close.
9. Deactivate control relays so that HVAC units shut down. Exception is for hazardous exhaust systems and smoke control.
10. Activate elevator recall sequence if smoke is detected in any elevator lobby, shaft, or in the elevator equipment room.
11. Activate control relay(s) to release all magnetically locked egress doors.

C. System Response to a Trouble Condition:

1. Systems AC power trouble signal shall not be sent unless maintained for 1 to 3 hours (or more) Provide additional relays as required for this purpose.
2. Provide immediate transmission of all other supervising signals.
3. Provide adjustable time delay for all other trouble signals prior to transmission.

D. System Capacity and General Operation: The system shall have the following capacities and general operation modes:

1. The FACP shall provide or be capable of expansion to 198 intelligent/addressable devices per Signaling Line Circuits (SLC) and 1980 initiating points, minimum, per system. The number of SLCs provided shall be as indicated on the Drawings. Total points shall be as indicated on the drawings or otherwise specified with minimum 20% spare capacity.

2. The FACP shall include a full featured operator interface control and annunciation panel that shall include a backlit, 80 minimum character liquid crystal display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
3. All programming or editing of the existing program in the system shall be achieved with a personal computer on site. A copy of the database shall be left in the Document Box per NFPA 72.
4. Notification Appliance Circuits with 20% spare capacity.

E. The FACP shall be able to provide the following features:

1. Upload/Download to PC Computer

    a. Charger Rate Control
    b. Drift Compensation
    c. Automatic Day/Night Sensitivity Adjust
    d. Device Blink Control
    e. Pre-alarm Control Panel Indication

2. Trouble Reminder
3. NFPA 72 Smoke Detector Sensitivity Test
4. System Status Reports
5. Periodic Detector Test
6. Alarm Verification, by device, with tally
7. Non-Alarm Module Reporting
8. Block Acknowledge
9. Smoke Detector Maintenance Alert
10. Control-By-Time

F. The control panel shall be capable of printing historical data and device parameters and shall include all equipment necessary to produce printouts, including an external printer and shall be U.L. listed as meeting the NFPA 72 sensitivity testing and maintenance requirements without the need for manually removing and testing each smoke detector. The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing. The system shall also annunciate a trouble condition when any smoke detector approaches 80% of its alarm threshold due to gradual contamination, with an annunciation of the location of the smoke detector requiring service. If any specialized equipment must be used to program any function of the smoke detector devices, then one must be furnished as part of the system.

G. The system shall perform time-based control functions including automatic changes of specified smoke detector sensitivity settings.

H. Central Processing Unit: The Central Processing Unit (CPU) shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.

1. The CPU shall contain and execute all control-by-event (including ANDing, ORing, NOTing, CROSSZONEing) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power

failure. The CPU shall also provide a real-time clock for time annotation of all system displays. The Time-of-Day and date shall not be lost if system primary and secondary power supplies fail.

2. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.

I. Operators Control: Provide an operator's interface which allows the following minimum functions. In addition, the operator's interface shall support any other functions required for system control and/or operation:

1. Acknowledge (ACK/STEP) Switch
2. Signal Silence Switch
3. System Reset Switch
4. System Test Switch
5. Lamp Test Switch
6. Programmable, supervised switches for fire safety function bypasses. i.e. NAC Bypass, Elevator Capture Bypass, HVAC Shutdown Defeat, Smoke Control Bypass, etc. Switch operation shall be password protected.

J. Display: The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.

1. The system display shall provide an 80minimum -character back-lit alphanumeric Liquid Crystal Display (LCD).
2. The Display shall also provide four Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, and SIGNAL SILENCE.
3. The system display shall provide a touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

    a. Signaling Line Circuit (SLC) Interface Board: The FACP shall contain SLC interface boards as required to communicate with the SLC. Each SLC board shall monitor and control a minimum of 198 intelligent addressable devices. This includes 99 analog detectors (Ionization, Photoelectric, or Thermal) and 99 monitor or control modules.

4. Each SLC interface board shall contain its own microprocessor and shall be capable of operating in a local mode (any SLC input activates all or specific SLC outputs) in the event of a failure in the main CPU of the control panel. The SLC interface board shall not require any jumper cuts or address switch settings to initialize SLC Loop operations. SLC interface boards shall provide power and communicate with all intelligent addressable detectors and modules connected to its SLC Loop on a single pair of wires. This SLC Loop shall be capable of operation as NFPA 72 Class A (Style 6) or Class X (Style 7).
5. Each SLC interface board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that specific detector. The SLC interface board software shall include

software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

K. Printer: Provide a printer to provide hard-copy printout of all changes in status of the system. The printer shall timestamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. Thermal printers are not acceptable. The printer shall operate from a 120 VAC, 60 Hz power source. Provide table and stand for printer if it is to remain constantly connected to the fire alarm panel.

L. Remote Transmissions: The FACP shall be interfaced to a Digital Alarm Communications Transmitter (DACT).

M. Power Supply: The FACP power supplies shall operate on 120 VAC, 60 Hz and shall have a continuous rating adequate to power all equipment and functions in full alarm continuously. All modules and drivers must be able to withstand prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage. Further, the power supply shall be expandable for additional notification appliance power in 3.0 Ampere increments.

N. The power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge.

O. Batteries: Shall be completely maintenance free, shall not require liquids, fluid level checks or refilling, and shall not be capable of producing spills and/or leaks. Batteries shall be sealed gel-cell type with expected life of 10 years. Battery voltage shall be as required by the FACP and related equipment. Battery shall have enough capacity to power the fire alarm system for not less than 60 hours plus 5 minutes of alarm upon a normal AC power failure. NAC circuits shall not exceed 75% of maximum current load allowed. (For batteries serving emergency voice communications the duration of alarm reserve shall be 15 minutes in lieu of 5 minutes)

P. Enclosures: The FACP shall be housed in a 3rd party listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left side (field selectable).

2.2 ALARM APPLIANCES

A. Programmable Electronic Sounders: Sounders located outdoors shall be listed for use in wet locations. Electric sounders shall operate with synchronized audible output and have the following specifications:

1. Voltage: Programmable electronic sounders shall operate on 24 VDC nominal.
2. Programming: Electronic Sounders shall provide the ANSI S3.41 three-pulse temporal pattern audible evacuation signal, described in NFPA 72, with an output sound level of at least 90 dBA measured at 10 feet from the device. Output sound level shall be 110 dB maximum. Electronic Sounders shall be field programmable without the use of special tools.

B. Strobe Lights shall be located as shown on the Drawings. Strobe lights indicated for use exterior to the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall operate with synchronized flash output and have the following specifications:

1. Voltage: Strobe lights shall operate on 24 VDC nominal.
2. Maximum pulse duration: 2/10ths of one second.
3. Strobe intensity and flash rate: Must meet minimum requirements of UL 1971. Provide strobe lights with minimum intensity Candela (Cd) rating of 15 Cd, or greater if such is indicated adjacent to the device symbol on the Drawings. The Fire Alarm Contractor shall verify all candela settings prior to conducting the voltage drop testing required later in this document. Contractor shall also verify the design candela settings are adequate for the space being covered. Care must be taken to assure the devices are mounted in the exact locations shown on the approved shop drawing documents. Notify the designer of any deficiencies.

C. Horns: Where provided, shall provide average ambient sound level of 15 dBA as listed in the NEPA 72.

D. Horns and sounder bases in bedrooms or other sleeping rooms shall operate at 520-Hz with frequency tolerance permitted in NFPA 72.

E. Audible/Visual Combination Devices shall comply with all applicable requirements for both Programmable Electronic Sounders and Strobe Lights.

F. Bells shall be 10" diameter vibrating type located as shown on the Drawings; bells located outdoors shall be listed for use in wet locations. Bells shall have the following specifications: Voltage: Bells shall operate on 24 VDC nominal.

2.3 INITIATING DEVICES

A. Addressable Devices - General: All initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:

1. All addressable spot type and duct smoke detectors shall be the analog type and the alarm system shall automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors. This feature must be armed, and sensitivities set prior to acceptance of the system.
2. Address Setting: Addressable devices shall provide an address-setting means.
3. Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with minimum two (2) wires.
4. Operational Indications: Addressable smoke and heat detectors shall provide dual LEDs. LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. The flashing mode operation of the detector LEDs shall be optional through the system field program.
5. Intelligent Initiation Devices: All smoke detectors shall be the "intelligent" in that smoke detector sensitivity shall be set through the FACP and shall be adjustable in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP on a time-of-day basis. Using software in the FACP, detectors shall be capable of automatically compensating for dust accumulation and other

slow environmental changes that may affect performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.

6. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtails.
7. Device mounting Base: Unless otherwise specified all detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
8. Sounder Base: Provide bases with a built-in (local) sounder rated at 85 dBA minimum, measured at 10ft. Configure sounder bases such that sounders are activated under conditions as described in the Matrix. Provide low frequency sounder bases in sleeping areas.
9. Test Means: The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel when in the "test" condition. Actual or synthetic smoke must be used during the 100% testing to assure smoke entry into the sensing chamber.
10. Device Identification: Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device.

B. Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

C. Ionization Smoke Detector: Ionization smoke detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

D. Thermal Detectors: Thermal Detectors shall be intelligent addressable devices rated at 135°F (58°C) and shall have a rate-of-rise element rated at 15° F. (9.4°C) per minute. It shall connect via minimum two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop. Thermal detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.

1. Non-Rate of Rise Detectors: Provide thermal detectors with non-rate of rise thermal elements. Non-rate of rise detectors is indicated by NRR adjacent to the thermal detector symbol. Where used in elevator machine rooms or hoist ways, select temperature rating nominal 10 degrees F less than the adjacent fire sprinkler.
2. Specialized Element Temperature Ratings: Provide thermal detectors with specialized element temperature ratings. Specialized element temperatures are indicated by a temperature rating adjacent to the thermal detector symbol, e.g. 195°F.

E. Multi-sensor Detectors: Detectors employ two or more of the above detection types with integrated operating principals, mounted in a single housing. The outputs of the analog sensors shall be transformed into digital signals that are combined and processed by special algorithms. The computations shall be designed to discriminate between normal ambient changes in a building and those changes associated with a fire. //Provide photoelectric smoke detection and rate of rise thermal detection. //Provide photoelectric smoke detection, ionization smoke detection and rate of rise thermal detection. //

F. Duct Smoke Detector: In-Duct Smoke Detector Housings shall accommodate a velocity rated photoelectric detector. The device, independent of the type used, shall provide continuous analog monitoring and alarm verification from the panel. When enough smoke is sensed, a supervisory or alarm signal shall be initiated at the FACP. Coordinate with owner for response appropriate for the location.

G. Addressable Pull Stations - General: Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except using a key. All pull stations shall be dual action, have a positive, visual indication of operation and utilize a key type reset. The Glass-break rods are not allowed. Mount pull station with operating mechanism between 42-inches and 48-inches above finished floor.

2.4 MISCELLANEOUS SYSTEM ITEMS

A. Addressable Dry Contact Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised zone (either Style D or Style B) of non-addressable Alarm Initiating Devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.

1. Indication of Operation: An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
2. Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler switch.

B. Two Wire Detector Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone, Class B (Style D or B operation) of non-addressable 2- wire smoke detectors or alarm initiating devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings. Indication of Operation: Unless otherwise indicated on the Drawings. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

C. Addressable Control Module: Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. The control module shall provide address-setting means. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel. If the voltage being controlled is 120 VAC or greater, an isolating 24 VDC relay shall be used.

1. Configuration: The control module NAC circuit may be wired for (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall be magnetically latched

to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires. Designer shall confirm the relay contacts are rated for the attached load.

2. Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, 3rd party listed remote power supply. A/V power sources and connections are not shown on the Drawings.

D. Isolator Module: Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop to 20 addressable devices. Modules must be readily accessible (not above ceiling) and clearly labeled.

1. Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module's operations shall be totally automatic.
2. The Isolator Modules shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated

E. Water Flow Switch: Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve as required per NFPA 13. Installation: Water Flow Switches shall be connected by the Division 16 (Electrical) Contractor but furnished and installed by the Division 23 (Mechanical) Contractor.

F. Sprinkler and Standpipe Valve Supervisory Switch: Supervisory switch mechanisms shall be contained in a weatherproof housings that shall provide a 3/4 inch tapped conduit entrance and shall incorporate the necessary facilities for attachment to the valves. Switch housing shall be finished in red baked enamel. Mounting: Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

G. Serially Connected Remote Annunciator: Annunciator shall communicate with the fire alarm control panel via an EIA-485 communications loop (four-wire) and shall individually annunciate all zones in the system. System zones shall be as indicated on the Drawings. Up to 10 annunciators may be connected to the EIA-485 communications loop.

1. Annunciator Indicators: The annunciator shall provide a red Alarm LED per zone, and a yellow Trouble LED per zone. The annunciator shall also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom zone/function identification labels. Annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, and Global System Reset. All annunciator switches and indicators shall be software programmable.
2. LCD Alphanumeric Display Annunciator: The Alphanumeric Display Annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text. The LCD Annunciator shall display all alarms and trouble conditions in the system.

3. System Capacity: The system shall allow a minimum of four LCD annunciators. In addition to annunciation functions, each LCD annunciator shall be capable of the following software programmed system functions: Acknowledge, Signal Silence and Reset.
4. Connections: The annunciator shall connect to a two-wire EIA-485 interface. The two-wire connection shall be capable operation at distances of 6,000 feet. Provide interface to fiber optic cable systems and/or repeater units where such are indicated on the Drawings.

H. Remote Annunciator Indicator Lights (RAIL): RAILs shall be provided with a key type switch for testing of the annunciated device. In addition. RAILs shall have the following features: Voltage: RAILs shall operate on 24 VDC nominal.

I. Door Hold-Open Magnets: Door hold open magnets shall be suitable for mounting in a single gang electrical device box. Door hold open magnets shall be furnished with keepers, door chains, and other accessories as required to properly hold open doors as indicated on the Drawings. Holding force of the magnet shall be appropriate for the door to be held open. Door hold open magnets shall operate in a fail safe manner, i.e., the door shall release in event of a failure of voltage to the device. Power Source: Door hold open magnets shall be configured to operate from a nominal 24 VDC system as supplied by the FACP or other power supply listed for the purpose. All hold open magnet supply sources, whether a part of the FACP or whether derived from a separate power supply, shall be supervised. Door hold open magnet circuits which use step-down transformers, 120 VAC, or local relays are not permitted. Door shall close after 60 seconds of the power loss.

J. Battery Power Supply (BPS) &/or Supplementary Notification Appliance Circuit (SNAC): These types of panels shall be completely maintenance free, shall not require liquids, fluid level checks or refilling, and shall not be capable of producing spills and/or leaks. Batteries shall be sealed gel-cell type with expected life of 10 years. Battery voltage shall be as required by the FACP and related equipment. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm upon a normal AC power failure. Battery cabinet shall be twice the size of the batteries it will contain. NAC circuits shall not exceed 75% of maximum current load allowed.

K. Surge Protection: The following protection against voltage transients and surges must be provided by the fire alarm equipment supplier, and installed by the electrical contractor:

1. On AC Input: A feed-through (not shunt-type) branch circuit transient suppressor such as Leviton 51020-WM-DIN, or Ditek DTK-120SRD 20 Amp or equivalent UL 1449 - Latest Edition Listed device.
2. On DC Circuits Extending Outside Building: At a point near entry to the building provide "pi"- type filter on each leg, consisting of a primary arrestor, series impedance, and a fast-acting secondary arrestor that clamps at 30v-40v.

    a. Some acceptable models: Simplex 2081-9027, Simplex 2081-9028, Transtector TSP8601, Ditek DTK 2MHLP24BWB series, Citel America B280-24V, and Northern Technologies DLP-42.
    b. Submit data on others to the engineer for approval. UL 497B listing is normally a prerequisite for their consideration. Devices using only MOV active elements are not acceptable.

2.5 Wiring

A. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. Belden 5320FJ acceptable if only FPL rating needed. The cable jacket color shall be red, with red (+) and black (-) conductor insulation.

1. Unshielded cable, otherwise equal to the above, is permitted to be used if the manufacturer's installation manual requires, or states preference for, unshielded cable.
2. In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.

PART 3 - EXECUTION

3.1 FIRE ALARM SYSTEM:

A. The fire alarm system shall be new and furnished with a warranty (parts & labor) of at least one year from the date of beneficial occupancy or final inspection by SCO and Owner. Equipment, initiating devices, and alarm appliances shall be arranged, and the annunciator zones shall be configured as described by the engineer’s written specifications.

B. All equipment supplied must be specifically listed for its intended use and shall be installed in accordance with the manufacture’s recommendations. The contractor shall consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Contractor shall refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.

C. Do not locate addressable modules in unconditioned spaces.

D. All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure. See Symbol sheet.

E. When programming the system, activate the automatic drift compensation feature for all spot type smoke detectors. Systems with alarm verification are not to have this feature activated without written direction from the owner's representative or the AHJ. Alarm verification must not be used with multi-sensor/multi-criteria detectors under any circumstances, as inadequate system response may result.

F. Set spot-type smoke detector sensitivities to normal/medium, unless directed otherwise by the design engineer/owner's rep.

G. Print a complete System Status and Programming Report after the above steps have been done. This must include the program settings for each alarm initiating device and the current sensitivity

of each analog addressable smoke detector. This documentation shall be provided at the SCO inspection.

3.2 FIRE ALARM CONTROL EQUIPMENT INSTALLATION

A. The technician who makes final connections and programs the FACP is the "installer" even though most field connections to system devices and appliances are normally made by electrical contractor personnel. The responsibility for assuring a proper installation overall rests with this individual fire alarm system technician. In addition to doing the final hookups and activating the system, this individual is expected to check the field connections to assure all work is properly done. The absence of system "trouble" signals is not an adequate measure of the field wiring, which could have "T" taps, the wrong type of wire, improper terminations, ground (drain wire) issues, etc.

B. Notification Appliance Circuit booster power supplies must be individually monitored by the FACP and protected by a smoke detector per NFPA 72. They shall not be located above a ceiling, or in non- conditioned space. A 24vdc power circuit serving addressable control relays must also be monitored for integrity. All fire alarm power supplies shall have 120-volts surge suppressors.

C. Basic operating instructions shall be framed and permanently mounted at the FACP. (If the owner concurs, they may instead be affixed to the inside of the FACP's door.) In addition, the NFPA 72 "Record of Completion" must either be kept at the FACP, or its location shall be permanently indicated there by an engraved label. All System documentation shall be provided and housed in a Documentation Cabinet at the control panel or other approved location. (Per 2013 NFPA 72: 7.7.2)

D. Provide an engraved label on outside of the FACP door identifying its 120-vac power source, as follows: Panelboard location, panelboard identification, and branch circuit number. On inside of FACP door, indicate panelboard location.

E. Alarm notification appliances (audible and visible) are to comply with NFPA 72, the North Carolina Building Code, and ANSI 117 criteria for intensity and placement. The standard audible evacuation signal is the ANSI S3.41 three-pulse temporal pattern. All strobe lights installed in a single space must be synchronized. Devices can be mounted on the ceiling. Wall mounted devices shall be mounted with the entire lens between 80” minimum and 96” maximum off finished floor. See the NFPA 72 for additional alarm notification appliance requirements for special situations.

3.3 SURGE PROTECTION

A. For each AC power circuit that interfaces with fire alarm equipment, install an AC suppressor in a listed enclosure near the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns, about 1" diameter, and securely tie-wrapped. This series impedance will improve the effectiveness of the suppressor in clipping fast rise time voltage transients.

B. On DC Circuits Extending Outside Building: Install the surge arrestor in a labeled enclosure near the point of entry to or exit from each building.

3.4 SIGNALING LINE CIRCUITS

A. One loop per floor for signaling-line circuits. Outgoing and return loops must be in separate raceways per 2013 NFPA 72. (12.3.7) Provide isolation modules (or isolator bases) along each SLC (addressable loop). 20 devices max between ISO's.

3.5 AC POWER

A. Systems are to be provided with a separate and independent source of emergency power. Switching to emergency power during alarm shall not cause signal drop-out. Batteries must meet the appropriate NFPA capacity requirements, with a 25% safety factor. This requirement is in effect even if generator power is supplied to the Fire Alarm Control Panel.

B. The branch circuit breaker(s) supplying the system must be physically protected by a breaker handle lock-on device and each must be identified with a 1/4" permanent red dot applied to handle or exposed body area.

C. Provide an engraved label at each fire alarm system control unit, system sub-panel or data gathering panel, supplementary notification appliance (SNAC) panel, digital alarm communicator, etc. identifying the panel location, panel name, and breaker number for the 120VAC circuit. Example:

1. Electrical Rm 120 Panel EP1
2. Circuit 22

D. The fire alarm system shall monitor 120-VAC power to shunt trip breakers used in conjunction with fire suppression systems. Examples include a shunt trip used for cooking appliance power shut-off when the kitchen hood fire suppression system shoots, or primary elevator power shut-down upon heat detector activation in sprinkled hoist ways or machine rooms. Use an addressable monitor module to accomplish this supervisory function. Provide a breaker handle lock-on device on circuits used for shunt trip power.

3.6 CONDUIT AND WIRING

A. The exterior of all junction boxes containing fire alarm conductors shall be painted red; box interiors shall not be painted. Box covers for junction boxes containing fire alarm conductors shall be painted red on both sides.

B. Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained therein. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

C. All fire alarm system wiring shall be in metal conduit or surface metal raceway. All fire alarm system raceway, couplers, and connectors must meet the performance and installation requirements of Electrical Specification Section "RACEWAYS".

1. Cable size and the requirement to maintain a Class "A" or Class "X" loop on all Signaling Line Circuits cause conduit fill to exceed specified maximums for the 1/2" size; therefore, 3/4" raceway should be used.

2. PVC conduit is permitted to be used underground, in concrete, and in locations approved by the AHJ.

D. All conduits that penetrate outside walls from air-conditioned space must have internal sealing (duct- seal), to prevent condensation from infiltrating humid air.

E. All wiring shall be color coded. All the circuits in the system shall be wired with AWG 14, minimum, stranded copper, THHN/THWN conductor, installed in metallic conduits. Color Coded wires shall be in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run:

1. Initiating Circuits, General ----------Red (+)/White (-)
2. Initiating Circuits, Smoke Only ----------Violet (+)/Gray (-)
3. Signal Line Circuit cable ----------Red jacket with Red (+)/Black (-)
4. Alarm Indicating Appliance Circuits --------- Blue (+)/Black (-)
5. AHU Shutdown Circuits ----------Yellow (+)/Brown (-)
6. Door Control Circuits ---------- Orange
7. Elevator Capture Circuits ---------- Brown

F. To minimize wiring fault impact, isolation modules shall be provided in all the locations listed below. If ceiling height ≤10 feet, isolator base type initiating devices are permitted to be used to satisfy any or all the following

1. In or immediately adjacent to the FACP, at each end of the addressable loop. These two isolators must be in the same room and within 15 feet of the FACP.
2. After each 20 initiating devices and control points on the addressable loop, or a lesser number where recommended by the manufacturer. (Check instructions.)
3. For loops with less than 20 devices and control points, install an isolator at the approximate middle of the loop (in addition to those at the FACP).
4. Near the point any addressable circuit extends outside the building, except for those attached to the building exterior walls and well sheltered by walkways.
5. For loops covering more than one floor, install isolator at terminal cabinet on each floor (with additional isolator[s] on any floor with over 20 addresses).
6. Each isolation module must be clearly labeled, readily accessible for convenient inspection (not above a lay-in ceiling), and shown on as-built drawings

G. Detection or alarm circuits must not be included in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power must be properly separated by a minimum of .25 inches per NEC, from other circuits, and the enclosure must have an appropriate warning label, to alert service personnel to the potential hazard. See NEC 760.136.

H. Class A or X Circuits Required: Systems with one or more addressable sub-panels that (1) have an integral addressable loop controller, or (2) monitor multiple non-addressable initiation zones, shall comply with the NFPA 72 requirements for Class “A” or “X” circuits for their networking cables.

I. There shall be no splices in the system other than at device terminal blocks, or on terminal blocks in cabinets. "Wire nuts" and crimp splices will not be permitted. Permanent wire markers shall be used to identify all connections at the FACP and other control equipment, at power supplies, and

in terminal cabinets. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

J. In multistory buildings, all circuits leaving the riser on each floor shall feed through a labeled terminal block in a hinged enclosure accessible from the floor. If building layout requires the terminal cabinet to be above a drop ceiling, its location must be clearly and permanently identified with a placard readable from floor. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

K. All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be ten (10) megohms, as verified with an insulation tester. Provide advanced notice to the Engineer of record of these tests.

L. The system shall be electrically supervised for open or (+/-) ground fault conditions in SLC, alarm circuits, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.

3.7 ADDRESSABLE PULL STATIONS

A. Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except using a key. All pull stations shall be dual action, have a positive, visual indication of operation and utilize a key type reset. Glass-break rods are not allowed. Mount pull station with operating mechanism between 42-inches and 48-inches above finished floor.

3.8 NOTIFICATION DEVICES

A. Both audible and visible alarm signals shall be provided. Visible signals for fire alarm must be the strobe (flash discharge) type, with white or clear lens, and shall comply with current ADA requirements for intensity and placement.

B. Alarm notification appliance (NAC) circuits shall be NFPA 72 Class “A” or Class “B”. The load connected to each circuit must not exceed 80% of rated module output. The NAC voltage drop during alarm must not exceed 14% of the voltage measured across the batteries at that time. To achieve this, the design must consider wire size, length of circuit, device load, inherent voltage loss within the FACP power supply, etc. The contractor shall use power outage testing to verify that the NAC circuit was designed and installed properly.

C. The location of all end of line devices shall be labeled on the device, with NAC panel number and NAC circuit number, and recorded on the “As-built” drawings. EOL shall not be located more than 12-feet above finished floor.

3.9 DETECTORS

A. The FACP and all other control equipment locations, including any transponders, sub-panels, and booster power supplies, must be protected by a spot type smoke detector located within 15 feet of the equipment (measured horizontally).

B. When installed in a room, detectors shall be oriented, so their alarm light is visible from the nearest door to the corridor, unless Remote Alarm Indicator Light (RAIL) equipped.

C. Spot-type smoke detectors shall secure the head to the base thru the built-in locking device. For detector mounted within 12 feet of the floor, activate this lock after the system has been inspected and given final acceptance.

D. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors must be replaced by the contractor at no additional cost to the Owner. Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and must not be used for that purpose. They are suitable only during final, minor cleanup or touchup operations.

E. A detector installed where accidental damage or deliberate abuse is expected shall be provided with a guard that is listed for use with it and is acceptable to the AHJ.

F. Identification of individual detectors is required. Assign each a unique number as follows, in sequence starting at the FACP: (Addressable Loop # -- Device #) Show on the as-built plans, and permanently mount on each detector's base so that it's readable standing on the floor below without having to remove the smoke detector. Exception: For detectors with housings (i.e., air duct, projected beam, air sampling, flame), apply the identification to a suitable location on exterior of their housing. Device labels may not be affixed to the device. Identification labels must be printed labels with black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

G. Addressable Interface Modules (control and monitor modules)

1. Addressable interface modules (used to monitor all contact type initiating devices) must be in a conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location.
2. One module may serve as many as 6 heat detectors, in a single space.

3.10 DUCT MOUNTED SMOKE DETECTORS

A. All air duct/plenum detectors must have a Remote Alarm Indicator Lamp with test switch (RAILS) installed in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. Duct smoke detectors are permitted to be installed only inside an air duct. It is not appropriate to mount them in front of a return air opening. Duct detectors shall also be installed in a manner that provides suitable, convenient access for required periodic cleaning and calibration. The numbers of detectors per duct shall be per NFPA 72 requirements based on the size of the air duct, air duct configuration, air speed, and duct manufacture’s installation requirements.

B. Each duct detector installation shall have a hinged or latched duct access panel, 12x12 inches minimum, for sampling tube inspection and cleaning. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.

C. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with far end support for stability.

1. The preferred method for providing support is to extend the intake tube through the far side of the duct, seal around the tube where it penetrates the duct wall and plug the end with a rubber stopper. This facilitates visual inspection and intake tube cleaning.

D. Duct smoke detector mounting position and air sampling tube orientation, are critical for proper operation. The Manufacturer's detailed installation instructions must be followed. The contractor shall mark the direction of air flow on the duct at each duct detector location.

E. Avoid the use of duct detectors on outside air intakes, as this can lead to nuisance alarms and troubles from moisture and dust.

F. A fire alarm panel output for a duct detector signal shall be as required by NC Building Codes and NFPA 72.

3.11 AIR HANDLER UNIT (AHU) SHUTDOWN

A. A supervised "AHU Shutdown Defeat" switch must be provided in/adjacent to the FACP or as a key- operated function in the Remote Annunciator (if provided). If the FAA option is utilized, provide an informative engraved label at the FACP about this function. The switch must cause a system "trouble" indication when it's placed in the off-normal ("Shutdown Defeated") position. This is to provide the owner with a convenient means to temporarily resume HVAC operation in the event an unwanted alarm will not clear, prior to arrival of the fire alarm service technician, or for testing purposes.

B. If the building has smoke control system fans (pressurization or exhaust), or smoke purge fans, provide Hand-Auto-Off switches at an approved location. They must be clearly labeled, and FACP - monitored or provided with status indicator lights. This is often provided by the controls contractor, rather than the fire alarm contractor, and does not need to be part of the fire alarm system. Responsibility should be clearly indicated in the project specification. For three-position toggle switches we recommend this intuitive arrangement: Hand (Manual Run) to be "up" and have an amber LED; Auto to be center position with a green LED; Off to be down and have a red LED.

C. All shutdown relays must be directly controlled and monitored by the fire alarm system. The Building Automation System (BAS) shall not be used for life safety functions unless the BAS is supervised by the Fire Alarm System for off normal conditions. Relays should be wired fail safe. (BAS systems typically are not battery backed and typically do not supervise themselves or their wiring, for faults or communication loss between processors or CPU’s.)

D. Buildings with smoke control or smoke removal systems shall have the Fire Fighter’s Smoke Control Panel monitored by the Fire Alarm System, for all trouble conditions.

3.12 REMOTE ALARM TRANSMISSION REQUIREMENTS

A. Each system with automatic fire detection, or which monitors a sprinkler system, shall be equipped with a 4-channel (minimum) Digital Alarm Communicator Transmitter (DACT) for transmission of fire alarm, supervisory, and trouble signals to a Central Station, Remote Supervising Station, or Proprietary Supervising Station. DACT shall be dual transmission link type in accordance with NFPA 72. Transmission shall be cellular and VOIP. Provide back-up power for signal transmission equipment as required in NFPA 72.'

B. The following signals shall be reported:

1. Fire Alarm
2. Fire Alarm System AC Power Trouble (only if 120vac interrupted for 1 to 8 hours). A power loss trouble signal may be delayed by no more than 3 hrs per NFPA 72.

C. The precedence of DACT / signals transmitted to the Supervising Station shall be as follows:

1. Fire Alarm
2. Supervisory Signal
3. Trouble Signal*

D. Do not confuse fire suppression system "supervisory" signals and fire alarm system "trouble" signals. These are completely different types of signals, annunciated and transmitted as separate and distinct events.

E. The Contractor must provide a type of DACT that is compatible with the owner's alarm receiving equipment, or the Supervising Station selected by the owner, as applicable. He must also program the PROM, connect each DACT to the data line provided to him, and verify proper signal receipt by the Supervising Station. The transmission means shall comply with NFPA 72.

3.13 FIRE ALARM SYSTEM INSTALLATION AND CONFIGURATION

A. Supervision required: The connection between individual addressable modules and their contact type initiating device(s) must be supervised.

B. Graphic Chart must be mounted behind Plexiglas and secured to surface. Mounting shall be such that charts cannot be removed without the proper tools.

C. Floor Plans with Device Numbers: A copy of the floor plans shall be provided in the Documentation Cabinet at the control panel. A separate sheet shall be provided for each floor. Plans shall be reduced in size from engineering plans in order to fit on 11 x 14 sheets. All device addresses shall be clearly labeled on plans. Indicate locations of all cabinets, modules and end of line device.

D. Loop 1 shall be assigned to the lowest level devices and loop number shall increase with floor number. Device numbering starts in the same location on each floor and increase accordingly as circuit location increases.

3.14 SYSTEM DOCUMENTATION, TRAINING, AND MAINTENANCE

A. Maintenance: The manufacturer, or authorized distributor, must maintain software version (VER) records on the system installed. The system software shall be upgraded free of any charge if a new VER is released during the warranty period. For new VER to correct operating problems, free upgrade shall apply during the entire life of the system.

B. System Report In addition to the Shop Drawing submittal described elsewhere, the fire alarm system contractor shall provide the engineer two bound copies of the following technical information, for transmittal to the owner:

1. As-Built wiring diagram showing all loop numbers and device addresses, plus terminal numbers where they connect to control equipment.
2. As-built wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing all interconnections in the system.
3. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
4. Manufacturer detailed maintenance requirement.
5. Technical literature on all control equipment, isolation modules, power supplies, batteries, detectors, manual stations, alarm/supervisory signal initiating devices, alarm notification appliances, relays, remote alarm transmission means, etc.
6. The as-built "calculations" sheet.

C. Electronic archive: Complete configuration data (site-specific programming) for the system must be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A USB drive or CD copy of this data shall be submitted to the engineer for transmission to the owner on the day the system is commissioned. A copy of this site-specific data base shall also be placed in the Documentation Cabinet.

D. The contractor shall provide the owner with one copy of the following:

1. All software required for the installed fire alarm system.
2. Complete documentation for all software for both the installed fire alarm system and for any interface PC software necessary for system functions as described above.
3. Framed floor plans mounted at the FACP: Plans shall show all system devices with the unique device identification numbers indicated adjacent to each device. The identification numbers shall match those represented in the as-built drawings and those reported at the FACP and the LCD annunciator. As-built room numbers shall match the signage in the building.
4. Interconnection cable where such is required to connect the fire alarm system to a PC; (if Owner does not have the needed PC to check the system).

E. The manufacturer's authorized representative must instruct the owner's designated employees in operation of the system, and in all required periodic maintenance. A minimum of 8 hours on-site time will be allocated for this purpose and, for those facilities operating on a 24-hour basis (prisons, hospitals, etc.) one additional hour of instruction will be individually provided for the 2nd and 3rd shift. Two copies of a written, bound summary will be provided, for future reference.

1. Some facilities maintain their own systems and require more in-depth training. Check to verify needs and requirements.

2. Scheduling of training must be arranged to meet the Owner's schedule. Additional training shall be available at a cost to be mutually agreed upon by the Owner and the Contractor.
3. Training shall be in the Owner's provided classroom.
4. The training may not be waived, deleted or reduced in the number of hours required.
5. Training shall cover as minimum the following topics:

    a. Preventive maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
    b. Overall system concepts, capabilities, and functions. Training shall be in depth, so that the owner shall be able to take any device out of service and return any device to service without need of Manufacturer's approval or assistance.
    c. Explanation of all control functions, including training to program and operate the system software.
    d. Methods and means of troubleshooting and replacement of all field wiring devices.
    e. Methods and procedures for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry and interconnections.
    f. Manuals, drawings, and technical documentation. Actual system software used for training shall be provided in digital form and shall be left with the Owner at the completion of training for the Owner's use in the future. *Training Quote: Provide a quote for one of the owner's Employees to receive factory certification level training on the system being installed. Quote is to include travel, room and food allowance.

3.15 SPARE PARTS:

A. The following spare parts shall be provided with the system. For multi-building projects, calculate quantities separately for each building that contains a dedicated fire alarm control panel. If FACP also serves auxiliary buildings (e.g., storage, boiler/chiller), calculate as if one building. Increase decimal quantities to the next higher whole number.

Fuses (If Used)	2 of each size in system
Manual Fire Alarm Boxes	2% of installed quantity
Addressable Control Relays	4% of installed quantity
Indoor Horns/Speakers with Strobes Lights	4% of installed quantity
Indoor Strobe-only Notification Appliances	4% of installed quantity
Monitor Modules (Addressable Interface)	4% of installed quantity
Isolation Modules / Isolation Bases	4% of installed quantity
Addressable, Electronic Heat Detectors	4% of installed quantity
Spot-Type Smoke Detectors / Sounder Bases	6% of installed quantity

No spares are required for projected beam, air sampling, or duct smoke detectors

3.16 SYSTEM TESTING & CERTIFICATION

A. Upon completion of the installation the Contractor and the Manufacturer's authorized installer and designer together shall conduct a 100% performance test of every alarm initiating device for proper response. The system shall operate for 48 hours prior to start of test. The Contractor shall be present for the full 100% test. The person responsible for programming the system must be present.

B. The A/E and owner must be given 7 days' notice of the tests. All Audio-Visual Device Testing shall be scheduled with the owner.

C. 100% Test: The manufacturer or authorized distributor (by definition, "installer") must 100% test all site-specific software functions for the system and then provide a detailed report or check list showing the system's operational matrix. This documentation must be part of the "System Status and Programming Report". Provide an alarm and trouble history printout at the SCO inspection, documenting this 100% test.

1. Upon completion of the installation and its programming, the installer's technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliances for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, motor control centers, etc. The engineer shall witness these tests.
2. If AHU shutdown occurs for any alarm, then the matrix would indicate the specific control relay(s) for that function being commanded to operate for alarm from any initiating device. If a rolling steel fire door is to drop only upon water flow alarm from its sprinkler zone, or upon any two spot smoke detectors in adjacent spaces being simultaneously in alarm, the matrix would show the door's control relay activating upon alarm from the applicable water flow switch(es), or from any two smoke detectors in the selected spaces (AND gate)
3. The digital communicator shall be on-line and tested for proper communication to the receiving station.
4. All supervised circuits must also be tested to verify proper supervision. (Control circuits and remote annunciation lines are among those required to be supervised.)
5. All testing described above shall be repeated if subsequent software or wiring modifications are determined necessary to meet the requirements of the contract documents. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.
6. The contractor and engineer shall verify the voltage drop of each NAC circuit by testing and recording the voltage at the origin and at the EOL for each NAC circuit, under battery power only. Prior to conducting these tests, the contractor shall verify the candela settings of all strobes. Provide documentation of these tests at the SCO final inspection.

D. Test Documentation: The installer must fill out and submit the following documentation to the owner, through the engineer, prior to the AHJ's system acceptance inspection:

1. Written verification that this 100% system test was done with copy of print out generated during test.
2. The NFPA 72, "Record of Completion" Form. Use this form (no substitutes) to detail the system installation and to certify that: (a.) It was done per Code, and (b.) The Code required 100% test was performed. The fire alarm installer (manufacturer or authorized distributor's

technician) must sign this form. If a representative of the AHJ, owner, or engineer witnesses the tests, in whole or in part, they must also sign the form to signify that fact only (annotating the form as needed to clarify their limited role).

3. For buildings with a smoke control or smoke purge system, an HVAC balance report, in the smoke control / smoke purge mode.
4. The System Status and Programming Report described in NFPA 72. This must be generated on the day of the system acceptance inspection and shall include the measured sensitivity of each smoke detector.
5. The purpose of doing Item (4) on the day of the inspection is to assure detector sensitivity has not been affected by construction dust. Prudent contractors will have taken measures to prevent detector contamination during construction and will also have had the system do a detector sensitivity test and printout prior to the day of the inspection, to make certain all devices are properly programmed and operating within their limits.

E. After completion of the 100% system test and submission of documentation as described above the installer is to request the engineer to set up an inspection. The system must operate for at least two days prior to this inspection. The responding Fire Department shall be notified of this, for pre- fire planning purposes. On local government projects, local fire authorities may also want to participate in system acceptance inspections. However, for State-owned property they have no inspection jurisdiction and, if present, are only to observe.

3.17 PRE -FINAL INSPECTION:

A. At the Owner’s request and after passing the Designer’s pre-final inspection, the Contractor and Manufacturer’s authorized installer will conduct system test in the presence of the Owner and the Designer.

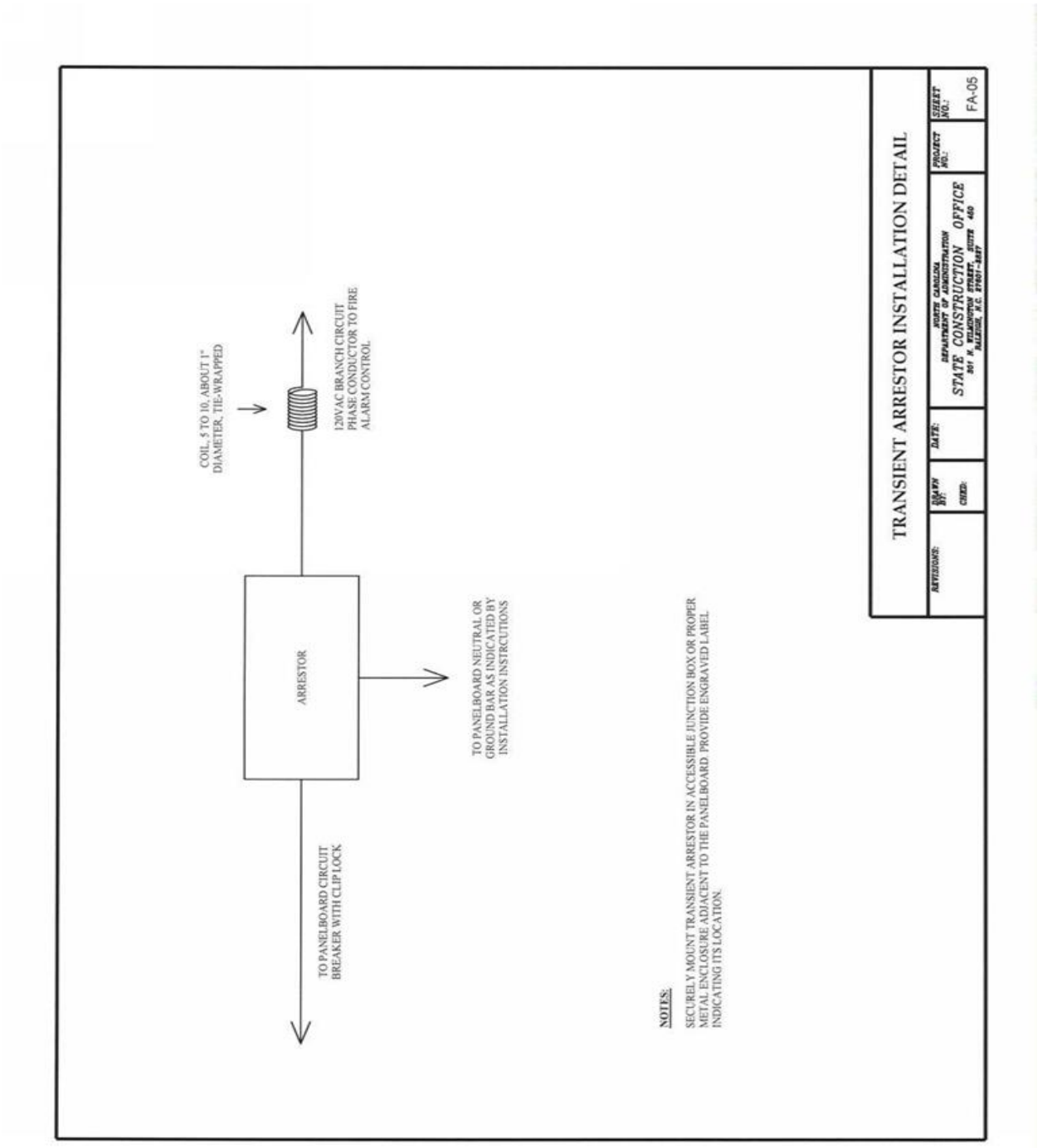
3.18 FINAL INSPECTION:

A. The fire alarm system will be inspected, with portions of it functionally tested. This will normally include the use of appropriate means to simulate smoke for testing detectors, as well as functionally testing the system interface with building controls, fire extinguishing systems and any off premises supervising station. Operation of any smoke removal system will be checked as instructed by the AHJ. This statistical (sampling) inspection is intended to assure that the contractor has properly installed the system and performed the 100% operational test as required by NFPA 72. The electrical contractor shall provide two-way radios, ladders, keys for resetting elevators and other equipment, and any other materials needed for testing the system, including a suitable smoke source. The Fire Alarm Contractor’s technician that programmed the system, shall be present on the day of the SCO inspection(s).

1. Smoke control and smoke management systems are normally tested by measuring air flow rates and pressure differentials, plus observing any effect the system has on the operation of exit, elevator, and stairway doors. Testing with smoke "bombs" (smoke candles) is NOT appropriate because they produce cold chemical smoke that lacks buoyancy and, therefore, does not rise like the smoke from a fire.
2. The test will be conducted entirely by the Contractor. A copy of the final database software must be presented to the Owner before this test. The software shall be loaded from these disks into the system in the presence of the Owner. The review will then be conducted

using this software. Any deficiencies shall be recorded and corrected. After the items have been corrected, the system shall be tested again.

a. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections.
b. Test Report: Upon successful completion of the Inspection and after the correction of all deficiencies, the manufacturer’s authorized representative shall issue a test report to the Engineer and Owner, detailing and certifying the test.
c. System Acceptance: After successful completion of the Final Inspection and recommendation of the Engineer, the system will be accepted by the Owner. At this time the warranty period begins.



END OF SECTION 283100

THIS PAGE IS INTENTIONALLY LEFT BLANK

FORM OF PROPOSAL

Beaufort County Community College
New Skills Building
SCO ID# 24-28654-01A

Contract: _____
Bidder: _____
Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

The Bidder proposes and agrees if this proposal is accepted to contract with The Trustees of ***Beaufort County Community College*** in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of ***New Skills Building*** in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of The Trustees of ***Beaufort County Community College and JKF ARCHITECTURE PC*** with a definite understanding that no money will be allowed for extra, work except as set forth in the General Conditions and the contract documents, for the sum of:

GENERAL CONSTRUCTION CONTRACT(Single-Prime):

Base Bid:

_____ Dollars ($ _____)

List Subcontractors:

Masonry Subcontractor _____ License No. _____

Plumbing Subcontractor: _____ License No. _____

Mechanical Subcontractor: _____ License No. _____

Electrical Subcontractor: _____ License No. _____

Roofing Subcontractor: _____ License No. _____

General Contractor shall complete all sections for Alternates and Unit Prices for Single-Prime Proposal.

The ***General*** contractor shall act as project expediter for all prime contracts. See Supplementary General Conditions.

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work thereunder within the time specified in the Supplementary General Conditions. Applicable liquidated damages shall be stated in the Supplementary General Conditions Article 23.

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

ALTERNATE BIDS (See Specification Section 012300 for complete description and time requirements)

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" or "deducted from" the base bid. (Strike out "Add" or "Deduct" as appropriate).

Alternate Bid No. 1 – Preferred Alternate; Fire Alarm System by Firelite.
Total Add/Deduct: _____ Dollars ($)

Alternate Bid No. 2 – Preferred Alternate; Door Hardware- Corbin-Russwin.
Total Add/Deduct: _____ Dollars ($)

UNIT PRICES (See Specification Section 012200 for complete description and time requirements)

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents

Unit Price No. 1– Remove and replace unsuitable soils in building pad or parking areas.

Total: _____ Dollars ($ per CY).

Unit Price No. 2– Remove and replacement unsuitable soils in footings, foundations, and utility trenches.

Total: _____ Dollars ($ per CY).

Unit Price No. 3 – Provide geotechnical fabric, geogrid, or other suitable stabilization material.

Total: _____ Dollars ($ per SY).

ALLOWANCES (See Specification Section 012100 for complete description and time requirements)

Allowance quoted are included in the Base Bid amount and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents.

Allowance No. 1: Remove unsuitable soils.

Total: _____ Dollars ($).

Allowance No. 2: Remove unsuitable soils (#57 Stone).

Total: _____ Dollars ($).

PROPOSAL SIGNATURE PAGE

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bond within ten (10) consecutive calendar days after written notice being given of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Attach certified check, cash or bid bond to this proposal.

Respectfully submitted this day of _____

_____
(Name of firm or corporation making bid)

WITNESS:

_____
(Proprietorship or Partnership)

By:_____
Signature

Name: _____
Print or type

Title_____
(Owner/Partner/Pres./V.Pres)

Address_____

_____

ATTEST:

By:_____

Title:_____
(Corp. Sec. or Asst. Sec. only)

License No._____

Federal I.D. No. _____

E-mail Address: _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____
Addendum No. 2 _____
Addendum No. 3_____
Addendum No. 4_____
Addendum No. 5 _____
Addendum No. 6 _____
Addendum No. 7 _____
Addendum No. 8 _____

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS THAT _____ _____ as principal, and _____, as surety, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto the Trustees of Beaufort Community College as obligee, in the penal sum of _____ DOLLARS, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this ____ day of _____ 20__

WHEREAS, the said principal is herewith submitting proposal for

and the principal desires to file this bid bond in lieu of making

the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the principal shall be awarded the contract for which the bid is submitted and shall execute the contract and give bond for the faithful performance thereof within ten days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so execute such contract and give performance bond as required by G.S. 143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further, that the bid may be withdrawn as provided by G.S. 143-129.1

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

DRAFT

FORM OF CONSTRUCTION CONTRACT

(ALL PRIME CONTRACTS)

THIS AGREEMENT, made the _____ day of _____ in the year of 2021 by and between _____

hereinafter called the Party of the First Part and The Trustees of Beaufort Community College; hereinafter called the Party of the Second Part.

WITNESSETH:

That the Party of the First Part and the Party of the Second Part for the consideration herein named agree as follows:

Scope of Work: The Party of the First Part shall furnish and deliver all of the materials, and perform all of the work in the manner and form as provided by the following enumerated plans, specifications and documents, which are attached hereto and made a part thereof as if fully contained herein: advertisement; Instructions to Bidders; General Conditions; Supplementary General Conditions; specifications; accepted proposal; contract; performance bond; payment bond; power of attorney; workmen's compensation; public liability; property damage and builder's risk insurance certificates; approval of attorney general; certificate by the Office of State Budget and Management, and drawings, titled:

Beaufort County Community College
New Skills Building
SCO ID# 24-28654-01A

Consisting of the following sheets: _____

_____

_____

Dated: _____ and the following addenda:

Addendum No	_____	Dated:	_____	Addendum No.	_____	Dated:	_____
Addendum No	_____	Dated:	_____	Addendum No.	_____	Dated:	_____
Addendum No	_____	Dated:	_____	Addendum No.	_____	Dated:	_____
Addendum No	_____	Dated:	_____	Addendum No.	_____	Dated:	_____

2. That the Party of the First Part shall commence work to be performed under this agreement on a date to be specified in a written order of the Party of the Second Part and shall fully complete all work hereunder within 210 consecutive calendar days from said date. For each day in excess thereof, liquidated damages shall be as stated in Supplementary General Conditions. The Party of the First Part, as one of the considerations for the awarding of this contract, shall furnish to the Party of the Second Part a construction schedule setting forth planned progress of the project broken down by the various divisions or part of the work and by calendar days as outlined in Article 14 of the General Conditions Contract.

3. The Party of the Second Part hereby agrees to pay to the Party of the First Part for the faithful performance of this agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the

DRAFT

United States as follows: ____
____($__________________).

Summary of Contract Award:

- X
- X
- x
-

4. In accordance with Article 31 and Article 32 of the General Conditions of the Contract, the Party of the Second Part shall review, and if approved, process the Party of the First Party's pay request within 30 days upon receipt from the Designer. The Party of the Second Part, after reviewing and approving said pay request, shall make payments to the Party of the First Part on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the First Party, less five percent (5%) of the amount of such estimate which is to be retained by the Second Party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the Second Party. The Second Party may elect to waive retainage requirements after 50 percent of the work has been satisfactorily completed on schedule as referred to in Article 31 of the General Conditions.

5. Upon submission by the First Party of evidence satisfactory to the Second Party that all payrolls, material bills and other costs incurred by the First Party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty (30) days after the completion by the First Party of all work covered by this agreement and the acceptance of such work by the Second Party.

6. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bonds hereto attached for its faithful performance, the Second Party shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds cease to be adequate to cover the performance of the work, the First Party shall, at its expense, within five (5) days after the receipt of notice from the Second Party so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Second Party. In such event no further payment to the First Party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Second Party.

7. The Party of the First Part attest that it and all of its subcontractors have fully complied with all requirements of NCGS 64 Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

IN WITNESS WHEREOF, the Parties hereto have executed this agreement on the day and date first above written in ____________ counterparts, each of which shall without proof or accounting for other counterparts, be deemed an original contract.

DRAFT

Witness:

_____
Contractor:(Trade or Corporate Name)

_____ By:_____
(Proprietorship or Partnership)

Attest: (Corporation) Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

(CORPORATE SEAL)

_____
The Trustees of Beaufort Community College

By:_____

Title: _____

Witness:

_____

DRAFT

FORM OF PERFORMANCE BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

DRAFT

Witness: _____

_____
Contractor: (Trade or Corporate Name)

By: _____

Attest: (Corporation)

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

_____
(Surety Company)

Witness: _____

By: _____

Title: _____
(Attorney in Fact)

Countersigned:

_____

(Surety Corporate Seal)

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

DRAFT

FORM OF PAYMENT BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project _____

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

DRAFT

Witness:

_____
(Proprietorship or Partnership)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

(Corporate Seal)

_____
Contractor: (Trade or Corporate Name)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

_____
(Surety Company)

Witness:

_____

By: _____

Title: _____
(Attorney in Fact)

Countersigned:

_____

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

(Surety Corporate Seal)

DRAFT

Sheet for Attaching Power of Attorney

DRAFT

Sheet for Attaching Insurance Certificates

DRAFT

APPROVAL OF THE ATTORNEY GENERAL

CERTIFICATION BY THE OFFICE OF STATE BUDGET AND MANAGEMENT

Provision for the payment of money to fall due and payable by the _____ _____ under this agreement has been provided for by allocation made and is available for the purpose of carrying out this agreement.

This _____ day of _____ _____ 20___.

Signed _____
Budget Officer

STATE OF NORTH CAROLINA
COUNTY SALES AND USE TAX REPORT
SUMMARY TOTALS AND CERTIFICATION

CONTRACTOR: _____ Page _____ of _____

PROJECT: _____ FOR PERIOD: _____

	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
CONTRACTOR							
SUBCONTRACTOR(S)*							
COUNTY TOTAL							

* Attach subcontractor(s) report(s)
** Must balance with Detail Sheet(s)

I certify that the above figures do not include any tax paid on supplies, tools and equipment which were used to perform this contract and only includes those building materials, supplies, fixtures and equipment which actually became a part of or annexed to the building or structure. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the _____ day of _____, 20____

_____
Signed

_____
Notary Public

_____
Print or Type Name of Above

My Commission Expires: _____

Seal

NOTE:
This certified statement may be subject to audit

STATE OF NORTH CAROLINA
SALES AND USE TAX REPORT DETAIL

CONTRACTOR: _____ Page _____ of _____

SUBCONTRACTOR _____ FOR PERIOD: _____

PROJECT: _____

PURCHASE DATE	VENDOR NAME	INVOICE NUMBER	TYPE OF PROPERTY	INVOICE TOTAL	COUNTY TAX PAID	COUNTY OF SALE *
				$	$	
				TOTAL:	$	

* If this is an out-of-state vendor, the County of Sale should be the county to which the merchandise was shipped.