ATHLETIC VILLAGE IMPROVEMENTS - NEW SOCCER BUILDING

JHS ARCHITECTURE: INTEGRATED DESIGN, INC.
1812 LINCOLN STREET; THIRD FLOOR
COLUMBIA, SOUTH CAROLINA 29201
803.252.2400
NOVEMBER 20, 2014

JHS PROJECT NO. 1019 **H27-6105-MJ-B**

TABLE OF CONTENTS

PROJECT NUMBER: H27-6105-MJ-B
PROJECT NAME: ATHLETIC VILLAGE IMPROVEMENTS –
NEW SOCCER BUILDING

SECTION

Table of Contents…….5

Invitation for Bids (SE-310)……..……...1

Instructions to Bidders (AIA Document A701 – 1997 Edition *)……...1

00201-0SE Standard Supplemental Instructions to Bidders…….. 9

Bid Bond (AIA A310)…… 2

Standard Bid Form (SE-330)……6

Standard Form of Agreement between Owner and Contractor (AIA Document A101 – 2007 Edition*)..……..……..…1

00501-OSE Standard Modifications to AIA A101-2007………3

General Conditions of the Contract for Construction (AIA Document A201 – 2007 Edition*)..……...…… 1

00811-OSE Standard Supplementary Conditions……25
(Supplement to AIA Document A201-2007 Edition General Conditions of the Contract)

USC SUPPLEMENTAL GENERAL CONDITIONS FOR CONSTRUCTION PROJECTS……4

Performance Bond (SE-355)…….……2

Labor and Material Payment Bond (SE-357)…….……2

CONSTRUCTION CHANGE ORDER (SE-380)…… 1

TECHNICAL SPECIFICATIONS

DIVISION 01 -- GENERAL REQUIREMENTS

- **01 1000 - Summary**
- **01 2000 - Price and Payment Procedures**
- **01 2300 - Alternates**
- **01 3000 - Administrative Requirements**
- **01 3216 - Construction Progress Schedule**
- **01 3553 - Security Procedures**
- **01 4000 - Quality Requirements**
- **01 4219 - Reference Standards**
- **01 5000 - Temporary Facilities and Controls**
- **01 5100 - Temporary Utilities**
- **01 5213 - Field Offices and Sheds**
- **01 5500 - Vehicular Access and Parking**
- **01 5721 - Indoor Air Quality Controls**
- **01 6000 - Product Requirements**
- **01 7000 - Execution and Closeout Requirements**
- **01 7419 - Construction Waste Management and Disposal**
- **01 7800 - Closeout Submittals**
- **01 7900 - Demonstration and Training**
- **01 8113 - Sustainable Design Requirements**
- **01 9113 - General Commissioning Requirements**
- **01 9114 - Commissioning Authority Responsibilities**

DIVISION 02 -- EXISTING CONDITIONS (NOT USED)

DIVISION 03 – CONCRETE

- **03 3000 – Cast-in-Place-Concrete**
- **03 4500 - Precast Architectural Concrete**

DIVISION 04 -- MASONRY

- **04 0511 - Masonry Mortaring and Grouting**
- **04 2000 – Unit Masonry**
- **04 2001 - Masonry Veneer**

DIVISION 05 -- METALS

- **05 1200 – Structural Steel Framing**
- **05 2100 - Steel joist Framing**
- **05 3100 - Steel Decking**
- **05 4000 - Cold- Formed Metal Framing**

05 5000 - Metal Fabrications
05 5100 - Metal Stairs
05 5213 - Pipe and Tube Railings
05 7300 - Decorative Metal Railings
DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES
06 1000 - Rough Carpentry
06 4100 - Architectural Wood Casework
06 4216 – Wood Veneer Paneling
DIVISION 07 -- THERMAL AND MOISTURE PROTECTION
07 1900 - Water Repellents
07 2100 - Thermal Insulation
07 2726 – Fluid-Applied Membrane Weather Air Barriers
07 4264 – Metal Composite Material Wall Panels
07 5423 - Thermoplastic-Polyolefin Roofing (TPO)
07 6200 - Sheet Metal Flashing and Trim
07 7200 – Roof Accessories
07 8400 – Firestopping
07 9005 – Joint Sealers
DIVISION 08 -- OPENINGS
08 1113 - Hollow Metal Doors and Frames
08 1416 - Flush Wood Doors
08 4126 - All-Glass Entrances and Storefronts
08 7100 - Door Hardware
08 8000 - Glazing
08 8300 - Mirrors
DIVISION 09 -- FINISHES
09 2116 - Gypsum Board Assemblies
09 2400 - Portland Cement Plastering
09 3000 - Tiling
09 5100 - Acoustical Ceilings
09 9000 - Painting and Coating
DIVISION 10 – SPECIALTIES
10 1101 – Visual Display Boards
10 2113.19 - Plastic Toilet Compartments
10 2800 - Toilet and Bath Accessories
10 4400 - Fire Protection Specialties
10 7113.43 - Fixed Sun Shades
DIVISION 11 -- EQUIPMENT
11 5213 – Projection Screen

DIVISION 12 -- FURNISHINGS

12 2113 - Horizontal Louver Blinds

12 2413 – Roller Window Shades

12 4813 - Entrance Floor Mats and Frames

DIVISION 13 -- SPECIAL CONSTRUCTION (Not Used)

DIVISION 14 -- CONVEYING EQUIPMENT (Not used)

DIVISION 21 -- FIRE SUPPRESSION

21 0000 - Fire Suppression

DIVISION 22 -- PLUMBING

220500 - Common Work Results for Plumbing

22 1100 - Facility Water distribution

22 1310 - Facility Sanitary Sewerage and Drain Piping

22 4000 - Plumbing Fixtures

DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 0500 - Common Work Results for HVAC

23 0548 - Vibration Isolation and Seismic Controls for HVAC Piping and Equipment

23 0553 - Identification for HVAC Piping and Equipment

23 0593 - Testing, Adjusting, and Balancing for HVAC

23 0700 - Insulation

23 3000 - HVAC Air Distribution

23 3416 - Centrifugal HVAC Fans

23 7223 - Energy Recovery Modules

23 8119 - Packaged Rooftop Units

DIVISION 25- INTEGRATED AUTOMATION

25 2500 – Integrated Automatic Facility Controls

DIVISION 26 – ELECTRICAL

26 0500 – Common Work Results for Electrical Systems

26 0503 – Equipment Wiring Connections

26 0519 – Low Voltage Electrical Power Conductors and Cables

26 0526 – Grounding and Bonding

26 0529 – Supports and Restraints

26 0533 – Raceways and Boxes

26 0534 – Floor Boxes

26 0536 – Cable Trays

26 0553 – Electrical Identification

26 0923 – Building Lighting Control Systems

26 2200 – Dry Type Transformers

26 2416 – Panelboards

26 2726 – Wiring Devices

26 2813 - Fuses

26 2819 – Enclosed Switches

26 4100 - Lightning Protection
26 4313 - Surge Protection Devices
26 5100 – Interior Lighting
26 5600 – Exterior Lighting
DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY
28 3111 - Fire Alarm System
DIVISION 31 -- EARTHWORK
31 1000 - Site Clearing
31 2000 – Earthwork
31 2500 – Environmental Protection
31 3116 - Termite Control
DIVISION 32 -- EXTERIOR IMPROVEMENTS
32 1123 – Aggregate Base Course
32 1216 - Hot- Mix Asphalt Paving
32 1313 - Concrete Sidewalks and Curb and Gutter
32 1314 - Portland Cement Concrete (Landscape)
32 1343 - Pervious Concrete Pavement
32 1400 - Unit Masonry (Landscape)
32 3223 - Segmental Retaining Walls
32 8400 - Underground Irrigation system (Landscape)
32 9202 - Grassing
32 9300 - Landscape Work (Landscape)
DIVISION 33 – UTILITIES
33 1100 – Water Distribution
33 1101 – Water Distribution (Fire)
33 3000 – Sanitary Sewers
33 4000 – Storm Drainage

END OF TABLE OF CONTENTS

2011 Edition
Rev. 7/28/2014

SE-310
REQUEST FOR ADVERTISEMENT

PROJECT NAME: ATHLETIC VILLAGE IMPROVEMENTS-NEW SOCCER BUILDING

PROJECT NUMBER: H27-6105-MJ-B

PROJECT LOCATION: COLUMBIA, SOUTH CAROLINA

Contractor may be subject to performance appraisal at close of project

BID SECURITY REQUIRED? Yes ☒ No ☐

PERFORMANCE & PAYMENT BONDS REQUIRED? Yes ☒ No ☐

CONSTRUCTION COST RANGE: 2,400,000.00 - 2,700,000.00

DESCRIPTION OF PROJECT: An approximately 11,200 square foot facilty to accommodate soccer locker rooms and weight rooms. A one (1) storied with a mezzanine. Designed to receive LEED "Silver" certificate by the USGBC..

A/E NAME: JHS ARCHITECTURAL: INTEGRATED DESIGN

A/E CONTACT: CLINT BURDETT

A/E ADDRESS: Street/PO Box: 1812 LINCOLN STREET
City: COLUMBIA
State: SC ZIP: 29201-2383

EMAIL: cburdett@jhs-architects.com

TELEPHONE: 803-252-2400 **FAX:** 803-252-1620

All questions & correspondence concerning this Invitation shall be addressed to the A/E.

BIDDING DOCUMENTS/PLANS MAY BE OBTAINED FROM: Bidders are responsible for obtaining all documentation from the USC purchasing website http://purchasing.sc.edu/. See "Facilities Construction Solicitations & Awards." Small & Minority participation is encouraged.

PLAN DEPOSIT AMOUNT: $0.00 **IS DEPOSIT REFUNDABLE:** Yes ☐ No ☐

Only those Bidding Documents/Plans obtained from the above listed source(s) are official. Bidders rely on copies of Bidding Documents/Plans obtained from any other source at their own risk.

BIDDING DOCUMENTS/PLANS ARE ALSO ON FILE FOR VIEWING PURPOSES ONLY AT *(list name and location for each plan room or other entity)*:

N/A

PRE-BID CONFERENCE? Yes ☒ No ☐ **MANDATORY ATTENDANCE?** Yes ☐ No ☒

DATE: 2/12/2015 **TIME:** 9:00AM **PLACE:** USC Facilities: 743 Greene Street, Columbia, SC 29208 Conf. Rm. 53

AGENCY: University of South Carolina

NAME OF AGENCY PROCUREMENT OFFICER: Clarissa Clark

ADDRESS: Street/PO Box: 743 Greene Street
City: Columbia
State: SC ZIP: 29208-

EMAIL: clarkcg2@mailbox.sc.edu

TELEPHONE: (803) 777-7162 **FAX:** (803) 777-7334

BID CLOSING DATE: 2/25/2015 **TIME:** 3:00PM **LOCATION:** USC Facilities: 743 Greene Street, Columbia, SC 29208 Conf. Rm. 53

BID DELIVERY ADDRESSES:

HAND-DELIVERY:

Attn: Clarissa Clark
USC- Facilities Planning & Construction
743 Greene St.
Columbia SC 29208

MAIL SERVICE:

Attn: Clarissa Clark
USC- Facilities Planning & Construction
743 Greene St.
Columbia SC 29208

IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? *(Agency MUST check one)* Yes ☐ No ☒

APPROVED BY *(Office of State Engineer)*: _____ **DATE:** 1/29/15

Section AIA A701-1997

Instructions to Bidders

Instructions to Bidders, AIA Document A701-1997 Edition, is incorporated into the Contract Documents by reference herein.

Copies of the Instructions to Bidders, AIA Document A701-1997, are available for examination at the office of the Architect. Copies of the Instructions to Bidders may also be obtained from the American Institute of Architects, 1735 New York Avenue, N.W. Washington DC 20006, or from local AIA offices and reprographic offices.

End of Section AIA A701-1997

OSE FORM 00201
STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

AGENCY: UNIVERSITY OF SOUTH CAROLINA

PROJECT NAME: ATHLETIC VILLAGE IMPROVEMENTS - NEW SOCCER BUILDING

PROJECT NUMBER: H27-6105-MJ-B

PROJECT LOCATION: COLUMBIA, SOUTH CAROLINA

PROCUREMENT OFFICER: CLARISSA CLARK

1. STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

1.1 These Standard Supplemental Instructions to Bidders amend or supplement Instructions to Bidders (AIA Document A701-1997) and other provisions of Bidding and Contract Documents as indicated below.

1.2 Compliance with these Standard Supplemental Instructions is required by the Office of State Engineer (OSE) for all State projects when competitive sealed bidding is used as the method of procurement.

1.3 All provisions of the A701-1997, which are not so amended or supplemented, remain in full force and effect.

1.4 Bidders are cautioned to carefully examine the Bidding and Contract Documents for additional instructions or requirements.

2. MODIFICATIONS TO A701-1997

2.1 *Delete Section 1.1 and insert the following:*

1.1 Bidding Documents, collectively referred to as the **Invitation for Bids**, include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement, Instructions to Bidders (A-701), Supplementary Instructions to Bidders, the bid form (SE-330), the Notice of Intent to Award (SE-370), and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda issued prior to execution of the Contract, and other documents set forth in the Bidding Documents. Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

2.2 *In Section 1.8, delete the words "and who meets the requirements set forth in the Bidding Documents".*

2.3 *In Section 2.1, delete the word "making" and substitute the word "submitting."*

2.4 *In Section 2.1.1:*
After the words "Bidding Documents," delete the word "or" and substitute the word "and."

Insert the following at the end of this section:
Bidders are expected to examine the Bidding Documents and Contract Documents thoroughly and should request an explanation of any ambiguities, discrepancies, errors, omissions, or conflicting statements. Failure to do so will be at the Bidder's risk. Bidder assumes responsibility for any patent ambiguity that Bidder does not bring to the Owner's attention prior to bid opening.

2.5 *In Section 2.1.3, insert the following after the term "Contract Documents" and before the period:*
and accepts full responsibility for any pre-bid existing conditions that would affect the Bid that could have been ascertained by a site visit. As provided in Regulation 19-445.2042(B), a bidder's failure to attend an advertised pre-bid conference will not excuse its responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the State.

2.6 *Insert the following Sections 2.2 through 2.6:*

2.2 CERTIFICATION OF INDEPENDENT PRICE DETERMINATION

GIVING FALSE, MISLEADING, OR INCOMPLETE INFORMATION ON THIS CERTIFICATION MAY RENDER YOU SUBJECT TO PROSECUTION UNDER SECTION 16-9-10 OF THE SOUTH CAROLINA CODE OF LAWS AND OTHER APPLICABLE LAWS.

OSE FORM 00201
STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

A. By submitting an bid, the bidder certifies that—

1. The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to—

a. Those prices;

b. The intention to submit an bid; or

c. The methods or factors used to calculate the prices offered.

2. The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

3. No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit a bid for the purpose of restricting competition.

B. Each signature on the bid is considered to be a certification by the signatory that the signatory—

1. Is the person in the bidder's organization responsible for determining the prices being offered in this bid, and that the signatory has not participated and will not participate in any action contrary to paragraphs A.1 through A.3 of this certification; or

2. **a.** Has been authorized, in writing, to act as agent for the bidder's principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs A.1 through A.3 of this certification [As used in this subdivision B.2.a, the term "principals" means the person(s) in the bidder's organization responsible for determining the prices offered in this bid];

b. As an authorized agent, does certify that the principals referenced in subdivision B.2.a of this certification have not participated, and will not participate, in any action contrary to paragraphs A.1 through A.3 of this certification; and

c. As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs A.1 through A.3 of this certification.

C. If the bidder deletes or modifies paragraph (a)(2) of this certification, the bidder must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

2.3 DRUG FREE WORKPLACE

By submitting a bid, the Bidder certifies that Bidder will maintain a drug free workplace in accordance with the requirements of Title 44, Chapter 107 of South Carolina Code of Laws, as amended.

2.4 CERTIFICATION REGARDING DEBARMENT AND OTHER RESPONSIBILITY MATTERS

A. **1.** By submitting an Bid, Bidder certifies, to the best of its knowledge and belief, that-

a. Bidder and/or any of its Principals-

(i) Are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any state or federal agency;

(ii) Have not, within a three-year period preceding this bid, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of bids; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(iii) Are not presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph A.1.a.(ii) of this provision.

b. Bidder has not, within a three-year period preceding this bid, had one or more contracts terminated for default by any public (Federal, state, or local) entity.

2. "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

B. Bidder shall provide immediate written notice to the Procurement Officer if, at any time prior to contract award, Bidder learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

C. If Bidder is unable to certify the representations stated in paragraphs A.1, Bidder must submit a written explanation regarding its inability to make the certification. The certification will be considered in connection with a review of the Bidder's responsibility. Failure of the Bidder to furnish additional information as requested by the Procurement Officer may render the Bidder nonresponsible.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph A. of this provision. The knowledge and information of a Bidder is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

D. The certification in paragraph A. of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Bidder knowingly or in bad faith rendered an erroneous certification, in addition to other remedies available to the State, the Procurement Officer may terminate the contract resulting from this solicitation for default.

2.5 ETHICS CERTIFICATE

By submitting a bid, the bidder certifies that the bidder has and will comply with, and has not, and will not, induce a person to violate Title 8, Chapter 13 of the South Carolina Code of Laws, as amended (ethics act). The following statutes require special attention: Section 8-13-700, regarding use of official position for financial gain; Section 8-13-705, regarding gifts to influence action of public official; Section 8-13-720, regarding offering money for advice or assistance of public official; Sections 8-13-755 and 8-13-760, regarding restrictions on employment by former public official; Section 8-13-775, prohibiting public official with economic interests from acting on contracts; Section 8-13-790, regarding recovery of kickbacks; Section 8-13-1150, regarding statements to be filed by consultants; and Section 8-13-1342, regarding restrictions on contributions by contractor to candidate who participated in awarding of contract. The state may rescind any contract and recover all amounts expended as a result of any action taken in violation of this provision. If contractor participates, directly or indirectly, in the evaluation or award of public contracts, including without limitation, change orders or task orders regarding a public contract, contractor shall, if required by law to file such a statement, provide the statement required by Section 8-13-1150 to the procurement officer at the same time the law requires the statement to be filed.

2.6 RESTRICTIONS APPLICABLE TO BIDDERS & GIFTS

Violation of these restrictions may result in disqualification of your bid, suspension or debarment, and may constitute a violation of the state Ethics Act. (a) After issuance of the solicitation, ***bidder agrees not to discuss this procurement activity in any way with the Owner or its employees, agents or officials.*** All communications must be solely with the Procurement Officer. This restriction may be lifted by express written permission from the Procurement Officer. This restriction expires once a contract has been formed. (b) Unless otherwise approved in writing by the Procurement Officer, ***bidder agrees not to give anything to the Owner, any affiliated organizations, or the employees, agents or officials of either, prior to award.*** (c) Bidder acknowledges that the policy of the State is that a governmental body should not accept or solicit a gift, directly or indirectly, from a donor if the governmental body has reason to believe the donor has or is seeking to obtain contractual or other business or financial relationships with the governmental body. Regulation 19-445.2165(C) broadly defines the term donor.

2.7 IRAN DIVESTMENT ACT CERTIFICATION

(a) The Iran Divestment Act List is a list published by the Board pursuant to Section 11-57-310 that identifies persons engaged in investment activities in Iran. Currently, the list is available at the following URL: http://procurement.sc.gov/PS/PS-iran-divestment.phtm(.) Section 11-57-310 requires the government to provide a person ninety days written notice before he is included on the list. The following representation, which is required by Section 11-57-330(A), is a material inducement for the State to award a contract to you. (b) By signing your Offer, you certify that, as of the date you sign, you are not on the then-current version of the Iran Divestment Act List. (c) You must notify the Procurement Officer immediately if, at any time before posting of a final statement of award, you are added to the Iran Divestment Act List.

2.7 *Delete Section 3.1.1 and substitute the following:*

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement in the number and for the deposit sum, if any, stated therein. If so provided in the Advertisement, the deposit will be refunded to all plan holders who return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

2.8 *Delete the language of Section 3.1.2 and insert the word "Reserved."*

2.9 *In Section 3.1.4, delete the words "and Architect may make" and substitute the words "has made."*

2.10 *Insert the following Section 3.1.5*

3.1.5 All persons obtaining Bidding Documents from the issuing office designated in the Advertisement shall provide that office with Bidder's contact information to include the Bidder's name, telephone number, mailing address, and email address.

OSE FORM 00201
STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

2.11 *In Section 3.2.2:*

Delete the words "and Sub-bidders"

Delete the word "seven" and substitute the word "ten"

2.12 *In Section 3.2.3:*
In the first Sentence, insert the word "written" before the word "Addendum."

Insert the following at the end of the section:
As provided in Regulation 19-445.2042(B), nothing stated at the pre-bid conference shall change the Bidding Documents unless a change is made by written Addendum.

2.13 *Insert the following at the end of Section 3.3.1:*
Reference in the Bidding Documents to a designated material, product, thing, or service by specific brand or trade name followed by the words "or equal" and "or approved equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

2.14 *Delete Section 3.3.2 and substitute the following:*

3.3.2 No request to substitute materials, products, or equipment for materials, products, or equipment described in the Bidding Documents and no request for addition of a manufacturer or supplier to a list of approved manufacturers or suppliers in the Bidding Documents will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids established in the Invitation for Bids. Any subsequent extension of the date for receipt of Bids by addendum shall not extend the date for receipt of such requests unless the addendum so specifies. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

2.15 *Delete Section 3.4.3 and substitute the following:*

3.4.3 Addenda will be issued no later than 120 hours prior to the time for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

2.16 *Insert the following Sections 3.4.5 and 3.4.6:*

3.4.5 When the date for receipt of Bids is to be postponed and there is insufficient time to issue a written Addendum prior to the original Bid Date, Owner will notify prospective Bidders by telephone or other appropriate means with immediate follow up with a written Addendum. This Addendum will verify the postponement of the original Bid Date and establish a new Bid Date. The new Bid Date will be no earlier than the fifth (5th) calendar day after the date of issuance of the Addendum postponing the original Bid Date.

3.4.6 If an emergency or unanticipated event interrupts normal government processes so that bids cannot be received at the government office designated for receipt of bids by the exact time specified in the solicitation, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal government processes resume. In lieu of an automatic extension, an Addendum may be issued to reschedule bid opening. If state offices are closed at the time a pre-bid or pre-proposal conference is scheduled, an Addendum will be issued to reschedule the conference.

2.17 *In Section 4.1.1, delete the word "forms" and substitute the words "SE-330 Bid Form."*

2.18 *Delete Section 4.1.2 and substitute the following:*

4.1.2 Any blanks on the bid form to be filled in by the Bidder shall be legibly executed in a non-erasable medium. Bids shall be signed in ink or other indelible media.

2.19 *Delete Section 4.1.3 and substitute the following:*

4.1.3 Sums shall be expressed in figures.

2.20 *Insert the following at the end of Section 4.1.4:*
Bidder shall not make stipulations or qualify his bid in any manner not permitted on the bid form. An incomplete Bid or information not requested that is written on or attached to the Bid Form that could be considered a qualification of the Bid, may be cause for rejection of the Bid.

2.21 *Delete Section 4.1.5 and substitute the following:*

4.1.5 All requested Alternates shall be bid. The failure of the bidder to indicate a price for an Alternate shall render the Bid non-responsive. Indicate the change to the Base Bid by entering the dollar amount and marking, as appropriate, the box for "ADD TO" or "DEDUCT FROM". If no change in the Base Bid is required, enter "ZERO" or "No Change." For add alternates to the base bid, Subcontractor(s) listed on page BF-2 of the Bid Form to perform Alternate Work shall be used for both Alternates and Base Bid Work if Alternates are accepted.

2.22 *Delete Section 4.1.6 and substitute the following:*

4.1.6 Pursuant to Title 11, Chapter 35, Section 3020(b)(i) of the South Carolina Code of Laws, as amended, Section 7 of the Bid Form sets forth a list of subcontractor specialties for which Bidder is required to identify only those subcontractors Bidder will use to perform the work of each listed specialty. Bidder must follow the Instructions in the Bid Form for filling out this section of the Bid Form. Failure to properly fill out Section 7 may result in rejection of Bidder's bid as non-responsive.

2.23 *Delete Section 4.1.7 and substitute the following:*

4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

2.24 *Delete Section 4.2.1 and substitute the following:*

4.2.1 If required by the Invitation for Bids, each Bid shall be accompanied by a bid security in an amount of not less than five percent of the Base Bid. The bid security shall be a bid bond or a certified cashier's check. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

2.25 *Delete Section 4.2.2 and substitute the following:*

4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney. The bid bond shall:

.1 Be issued by a surety company licensed to do business in South Carolina;

.2 Be issued by a surety company having, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty", which company shows a financial strength rating of at least five (5) times the contract price.

.3 Be enclosed in the bid envelope at the time of Bid Opening, either in paper copy or as an electronic bid bond authorization number provided on the Bid Form and issued by a firm or organization authorized by the surety to receive, authenticate and issue binding electronic bid bonds on behalf the surety.

2.26 *Delete Section 4.2.3 and substitute the following:*

4.2.3 By submitting a bid bond via an electronic bid bond authorization number on the Bid Form and signing the Bid Form, the Bidder certifies that an electronic bid bond has been executed by a Surety meeting the standards required by the Bidding Documents and the Bidder and Surety are firmly bound unto the State of South Carolina under the conditions provided in this Section 4.2.

2.27 *Insert the following Section 4.2.4:*

4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and performance and payment bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

2.28 *Delete Section 4.3.1 and substitute the following:*

4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall, unless hand delivered by the Bidder, be addressed to the Owner's designated purchasing office as shown in the Invitation for Bids. The envelope shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail or special delivery service (UPS, Federal Express, etc.), the envelope should be labeled "BID ENCLOSED" on the face thereof. Bidders hand delivering their Bids shall deliver Bids to the place of the Bid Opening as shown in the Invitation for Bids. Whether or not Bidders attend the Bid Opening, they

shall give their Bids to the Owner's procurement officer or his/her designee as shown in the Invitation for Bids prior to the time of the Bid Opening.

2.29 *Insert the following Section 4.3.6 and substitute the following:*

4.3.5 The official time for receipt of Bids will be determined by reference to the clock designated by the Owner's procurement officer or his/her designee. The procurement officer conducting the Bid Opening will determine and announce that the deadline has arrived and no further Bids or bid modifications will be accepted. All Bids and bid modifications in the possession of the procurement officer at the time the announcement is completed will be timely, whether or not the bid envelope has been date/time stamped or otherwise marked by the procurement officer.

2.30 *Delete Section 4.4.2 and substitute the following:*

4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be withdrawn in person or by written notice to the party receiving Bids at the place designated for receipt of Bids. Withdrawal by written notice shall be in writing over the signature of the Bidder.

2.31 *In Section 5.1, delete everything following the caption "OPENING OF BIDS" and substitute the following:*

5.1.1 Bids received on time will be publicly opened and will be read aloud. Owner will not read aloud Bids that Owner determines, at the time of opening, to be non-responsive. .

5.1.2 At bid opening, Owner will announce the date and location of the posting of the Notice of Intended Award.

5.1.3 Owner will send a copy of the final Bid Tabulation to all Bidders within ten (10) working days of the Bid Opening.

5.1.4 If Owner determines to award the Project, Owner will, after posting a Notice of Intended Award, send a copy of the Notice to all Bidders.

5.1.5 If only one Bid is received, Owner will open and consider the Bid.

2.32 *In Section 5.2, insert the section number "5.2.1" before the words of the "The Owner" at the beginning of the sentence.*

2.33 *Insert the following Sections 5.2.2 and 5.2.3:*

5.2.2 The reasons for which the Owner will reject Bids include, but are not limited to:

- **.1** Failure by a Bidder to be represented at a Mandatory Pre-Bid Conference or site visit;
- **.2** Failure to deliver the Bid on time;
- **.3** Failure to comply with Bid Security requirements, except as expressly allowed by law;
- **.4** Listing an invalid electronic Bid Bond authorization number on the bid form;
- **.5** Failure to Bid an Alternate, except as expressly allowed by law;
- **.6** Failure to list qualified Subcontractors as required by law;
- **.7** Showing any material modification(s) or exception(s) qualifying the Bid;
- **.8** Faxing a Bid directly to the Owner or their representative; or
- **.9** Failure to include a properly executed Power-of-Attorney with the bid bond.

5.2.3 The Owner may reject a Bid as nonresponsive if the prices bid are materially unbalanced between line items or sub-line items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Owner even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

2.34 *Delete Section 6.1 and substitute the following:*

6.1 CONTRACTOR'S RESPONSIBILITY

Owner will make a determination of Bidder's responsibility before awarding a contract. Bidder shall provide all information and documentation requested by the Owner to support the Owner's evaluation of responsibility. Failure of Bidder to provide requested information is cause for the Owner, at its option, to determine the Bidder to be non-responsible

2.35 *Delete the language of Section 6.2 and insert the word "Reserved."*

2.36 *Delete the language of Sections 6.3.2, 6.3.3, and 6.3.4 and insert the word "Reserved" after each Section Number.*

OSE FORM 00201
STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

2.37 *Insert the following Section 6.4*

6.4 CLARIFICATION

Pursuant to Section 11-35-1520(8), the Procurement Officer may elect to communicate with a Bidder after opening for the purpose of clarifying either the Bid or the requirements of the Invitation for Bids. Such communications may be conducted only with Bidders who have submitted a Bid which obviously conforms in all material aspects to the Invitation for Bids and only in accordance with Appendix D (Paragraph A(6)) to the Manual for Planning and Execution of State Permanent Improvement, Part II. Clarification of a Bid must be documented in writing and included with the Bid. Clarifications may not be used to revise a Bid or the Invitation for Bids. [Section 11-35-1520(8); R.19-445.2080]

2.38 *Delete Section 7.1.2 and substitute the following:*

7.1.2 The performance and payment bonds shall conform to the requirements of Section 11.4 of the General Conditions of the Contract. If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid.

2.39 *Delete the language of Section 7.1.3 and insert the word "Reserved."*

2.40 *In Section 7.2, insert the words "CONTRACT, CERTIFICATES OF INSURANCE" into the caption after the word "Delivery."*

2.41 *Delete Section 7.2.1 and substitute the following:*

7.2.1 After expiration of the protest period, the Owner will tender a signed Contract for Construction to the Bidder and the Bidder shall return the fully executed Contract for Construction to the Owner within seven days thereafter. The Bidder shall deliver the required bonds and certificate of insurance to the Owner not later than three days following the date of execution of the Contract. Failure to deliver these documents as required shall entitle the Owner to consider the Bidder's failure as a refusal to enter into a contract in accordance with the terms and conditions of the Bidder's Bid and to make claim on the Bid Security for re-procurement cost.

2.42 *Delete the language of Section 7.2.2 and insert the word "Reserved."*

2.43 *Delete the language of Article 8 and insert the following:*

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on South Carolina Modified AIA Document A101, 2007, Standard Form of Agreement Between Owner and Contractor as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor.

2.44 *Insert the following Article 9:*

ARTICLE 9 MISCELLANEOUS

9.1 NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING
IMPORTANT TAX NOTICE - NONRESIDENTS ONLY

Withholding Requirements for Payments to Nonresidents: Section 12-8-550 of the South Carolina Code of Laws requires persons hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within South Carolina to withhold 2% of each payment made to the nonresident. The withholding requirement does not apply to (1) payments on purchase orders for tangible personal property when the payments are not accompanied by services to be performed in South Carolina, (2) nonresidents who are not conducting business in South Carolina, (3) nonresidents for contracts that do not exceed $10,000 in a calendar year, or (4) payments to a nonresident who (a) registers with either the S.C. Department of Revenue or the S.C. Secretary of State and (b) submits a Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to the person letting the contract.

For information about other withholding requirements (e.g., employee withholding), contact the Withholding Section at the South Carolina Department of Revenue at 803-898-5383 or visit the Department's website at: www.sctax.org

This notice is for informational purposes only. This Owner does not administer and has no authority over tax issues. All registration questions should be directed to the License and Registration Section at 803-898-5872 or to the South Carolina Department of Revenue, Registration Unit, Columbia, S.C. 29214-0140. All withholding questions should be directed to the Withholding Section at 803-898- 5383.

PLEASE SEE THE "NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING" FORM (Available through SC Department of Revenue).

OSE FORM 00201
STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

9.2 CONTRACTOR LICENSING

Contractors and Subcontractors listed in Section 7 of the Bid Form who are required by the South Carolina Code of Laws to be licensed, must be licensed at the time of bidding.

9.3 SUBMITTING CONFIDENTIAL INFORMATION

For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "CONFIDENTIAL" every page, or portion thereof, that Bidder contends contains information that is exempt from public disclosure because it is either (a) a trade secret as defined in Section 30-4-40(a)(1), or (b) privileged & confidential, as that phrase is used in Section 11-35-410. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the words "TRADE SECRET" every page, or portion thereof, that Bidder contends contains a trade secret as that term is defined by Section 39-8-20 of the Trade Secrets Act. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "PROTECTED" every page, or portion thereof, that Bidder contends is protected by Section 11-35-1810. All markings must be conspicuous; use color, bold, underlining, or some other method in order to conspicuously distinguish the mark from the other text. Do not mark your entire bid as confidential, trade secret, or protected! If your bid, or any part thereof, is improperly marked as confidential or trade secret or protected, the State may, in its sole discretion, determine it nonresponsive. If only portions of a page are subject to some protection, do not mark the entire page. By submitting a response to this solicitation, Bidder (1) agrees to the public disclosure of every page of every document regarding this solicitation or request that was submitted at any time prior to entering into a contract (including, but not limited to, documents contained in a response, documents submitted to clarify a response, & documents submitted during negotiations), unless the page is conspicuously marked "TRADE SECRET" or "CONFIDENTIAL" or "PROTECTED", (2) agrees that any information not marked, as required by these bidding instructions, as a "Trade Secret" is not a trade secret as defined by the Trade Secrets Act, & (3) agrees that, notwithstanding any claims or markings otherwise, any prices, commissions, discounts, or other financial figures used to determine the award, as well as the final contract amount, are subject to public disclosure. In determining whether to release documents, the State will detrimentally rely on Bidders's marking of documents, as required by these bidding instructions, as being either "Confidential" or "Trade Secret" or "PROTECTED". By submitting a response, Bidder agrees to defend, indemnify & hold harmless the State of South Carolina, its officers & employees, from every claim, demand, loss, expense, cost, damage or injury, including attorney's fees, arising out of or resulting from the State withholding information that Bidder marked as "confidential" or "trade secret" or "PROTECTED".

9.4 POSTING OF INTENT TO AWARD

Notice of Intent to Award, SE-370, will be posted at the following location:

Room or Area of Posting: Receptionist Area

Building Where Posted: USC Campus Planning and Construction Office

Address of Building: 743 Greene Street, Columbia, South Carolina 29208

WEB site address (if applicable): http:// purchasing.sc.edu/

Posting date will be announced at bid opening. In addition to posting the notice, the Owner will promptly send all responsive bidders a copy of the notice of intent to award and the final bid tabulation

9.5 PROTEST OF SOLICITATION OR AWARD

Any prospective bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the solicitation of a contract shall protest within fifteen days of the date of issuance of the applicable solicitation document at issue. Any actual bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the intended award or award of a contract shall protest within ten days of the date notification of intent to award is posted in accordance with Title 11, Chapter 35, Section 4210 of the South Carolina Code of Laws, as amended. A protest shall be in writing, shall set forth the grounds of the protest and the relief requested with enough particularity to give notice of the issues to be decided, and must be received by the State Engineer within the time provided.

Any protest must be addressed to the CPO, Office of State Engineer, and submitted in writing:

A. by email to protest-ose@mmo.sc.gov,

B. by facsimile at 803-737-0639, or

C. by post or delivery to 1201 Main Street, Suite 600, Columbia, SC 29201.

By submitting a protest to the foregoing email address, you (and any person acting on your behalf) consent to receive communications regarding your protest (and any related protests) at the e-mail address from which you sent your protest.

OSE FORM 00201
STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

9.6 SOLICITATION INFORMATION FROM SOURCES OTHER THAN OFFICIAL SOURCE

South Carolina Business Opportunities (SCBO) is the official state government publication for State of South Carolina solicitations. Any information on State agency solicitations obtained from any other source is unofficial and any reliance placed on such information is at the bidder's sole risk and is without recourse under the South Carolina Consolidated Procurement Code.

9.7 BUILDER'S RISK INSURANCE

Bidders are directed to Article 11.3 of the South Carolina Modified AIA Document A201, 2007 Edition, which, unless provided otherwise in the bid documents, requires the contractor to provide builder's risk insurance on the project.

9.8 TAX CREDIT FOR SUBCONTRACTING WITH MINORITY FIRMS

Pursuant to Section 12-6-3350, taxpayers, who utilize certified minority subcontractors, may take a tax credit equal to 4% of the payments they make to said subcontractors. The payments claimed must be based on work performed directly for a South Carolina state contract. The credit is limited to a maximum of fifty thousand dollars annually. The taxpayer is eligible to claim the credit for 10 consecutive taxable years beginning with the taxable year in which the first payment is made to the subcontractor that qualifies for the credit. After the above ten consecutive taxable years, the taxpayer is no longer eligible for the credit. The credit may be claimed on Form TC-2, "Minority Business Credit." A copy of the subcontractor's certificate from the Governor's Office of Small and Minority Business (OSMBA) is to be attached to the contractor's income tax return. Taxpayers must maintain evidence of work performed for a State contract by the minority subcontractor. Questions regarding the tax credit and how to file are to be referred to: SC Department of Revenue, Research and Review, Phone: (803) 898-5786, Fax: (803) 898-5888. The subcontractor must be certified as to the criteria of a "Minority Firm" by the Governor's Office of Small and Minority Business Assistance (OSMBA). Certificates are issued to subcontractors upon successful completion of the certification process. Questions regarding subcontractor certification are to be referred to: Governor's Office of Small and Minority Business Assistance, Phone: (803) 734-0657, Fax: (803) 734-2498. Reference: SC §11-35-5010 – Definition for Minority Subcontractor & SC §11-35-5230 (B) – Regulations for Negotiating with State Minority Firms.

9.9 OTHER SPECIAL CONDITIONS OF THE WORK

NONE

END OF DOCUMENT

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)
University of South Carolina
743 Greene Street
Columbia, S. C. 29208

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)
Athletic Village Improvements
New Soccer Building
Project #H27-6105-MJ-B

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

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so

Init.
/

furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	(Contractor as Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

SE-330 – LUMP SUM BID
BID FORM

Bidders shall submit bids on only Bid Form SE-330.

BID SUBMITTED BY:_____
(Bidder's Name)

BID SUBMITTED TO: University of South Carolina
(Owner's Name)

FOR PROJECT: PROJECT NAME Athletic Village Improvements - New Soccer Building

PROJECT NUMBER H27-6105-MJ-B

OFFER

§ 1. In response to the Invitation for Construction Bids and in compliance with the Instructions to Bidders for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the Owner on the terms included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

§ 2. Pursuant to Section 11-35-3030(1) of the SC Code of Laws, as amended, Bidder has submitted Bid Security as follows in the amount and form required by the Bidding Documents:

☐ Bid Bond with Power of Attorney ☐ Electronic Bid Bond ☐ Cashier's Check
(Bidder check one)

§ 3. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into this Bid:

ADDENDUM No:_____

§ 4. Bidder accepts all terms and conditions of the Invitation for Bids, including, without limitation, those dealing with the disposition of Bid Security. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of 60 Days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner.

§ 5. Bidder herewith offers to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the following items of construction work:

§ 6.1 BASE BID WORK ***(as indicated in the Bidding Documents and generally described as follows)*****:** An approximately 11,200 square foot facilty to accommodate soccer locker rooms and weight rooms. A one (1) storied with a mezzanine. Designed to receive LEED "Silver" certificate by the USGBC..,

_____, which sum is hereafter called the Base Bid.
(Bidder - insert Base Bid Amount on line above)

SE-330 – LUMP SUM BID
BID FORM

§ 6.2 BID ALTERNATES - as indicated in the Bidding Documents and generally described as follows:

ALTERNATE # 1 *(Brief Description)*: LANDSCAPING PLANS AS SHOWN ON SHEETS L-1, L-2, AND IRRIGATION PLAN SHOWN ON SHEET I-1

☐ **ADD TO** or ☐ **DEDUCT FROM BASE BID:**_____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

ALTERNATE # 2 *(Brief Description)*: HARDSCAPE LANDSCAPING INCLUDING BRICK COLUMNS AND ASSOCIATED FOOTINGS AND WROUGHT IRON FENCING AND GATES AS SHOWN ON SHEETS S1, S2, S3, AND S4.

☐ **ADD TO** or ☐ **DEDUCT FROM BASE BID:**_____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

ALTERNATE # 3 *(Brief Description)*: _____

☐ **ADD TO** or ☐ **DEDUCT FROM BASE BID:**_____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

SE-330 – LUMP SUM BID

BID FORM

§ 7. LISTING OF PROPOSED SUBCONTRACTORS PURSUANT TO SECTION 3020(b)(i), CHAPTER 35, TITLE 11 OF THE SOUTH CAROLINA CODE OF LAWS, AS AMENDED – ***(See Instructions on the following page BF-2A)***

Bidder shall use the below-listed Subcontractors in the performance of the Subcontractor Specialty work listed:

SUBCONTRACTOR SPECIALTY By License Classification and/or Subclassification (Completed by Owner)	**SUBCONTRACTOR'S PRIME CONTRACTOR'S NAME** (Must be completed by Bidder) **BASE BID**	**SUBCONTRACTOR'S PRIME CONTRACTOR'S SC LICENSE NUMBER**
Mechanical- HT & AC		
Electrical -EL		
Plumbing-PB		
ALTERNATE 1		
ALTERNATE 2		
ALTERNATE 3		

If a Bid Alternate is accepted, Subcontractors listed for the Bid Alternate shall be used for the work of both the Alternate and the Base Bid work.

SE-330 – LUMP SUM BID
BID FORM

INSTRUCTIONS FOR SUBCONTRACTOR LISTING

1. Section 7 of the Bid Form sets forth a list of subcontractor specialties for which bidder is required to identify by name the subcontractor(s)Bidder will use to perform the work of each listed specialty. Bidder must identify only the subcontractor(s) who will perform the work and no others.

2. For purposes of subcontractor listing, a Subcontractor is an entity who will perform work or render service to the prime contractor to or about the construction site. Material suppliers, manufacturers, and fabricators that will not perform physical work at the site of the project but will only supply materials or equipment to the bidder or proposed subcontractor(s) are not subcontractors and Bidder should not insert their names in the spaces provided on the bid form. Likewise, Bidder should not insert the names of sub-subcontractors in the spaces provided on the bid form but only the names of those entities with which bidder will contract directly.

3. Bidder must only insert the names of subcontractors who are qualified to perform the work of the listed specialties as specified in the Bidding Documents and South Carolina Licensing Laws**.**

4. If under the terms of the Bidding Documents, Bidder is qualified to perform the work of a specialty listed and Bidder does not intend to subcontract such work but to use Bidder's own employees to perform such work, the Bidder must insert its own name in the space provided for that specialty.

5. If Bidder intends to use multiple subcontractors to perform the work of a single specialty listing, Bidder must insert the name of each subcontractor Bidder will use, preferably separating the name of each by the word **"and"**. If Bidder intends to use both his own employees to perform a part of the work of a single specialty listing and to use one or more subcontractors to perform the remaining work for that specialty listing, bidder must insert his own name and the name of each subcontractor, preferably separating the name of each with the word **"and"**.

6. Bidder may not list subcontractors in the alternative nor in a form that may be reasonably construed at the time of bid opening as a listing in the alternative. A listing that requires subsequent explanation to determine whether or not it is a listing in the alternative is non-responsive. If bidder intends to use multiple entities to perform the work for a single specialty listing, bidder must clearly set forth on the bid form such intent. Bidder may accomplish this by simply inserting the word "**and**" between the name of each entity listed for that specialty. Owner will reject as non-responsive a listing that contains the names of multiple subcontractors separated by a blank space, the word "or", a virgule (that is a /), or any separator that the Owner may reasonably interpret as a listing in the alternative.

7. If Bidder is awarded the contract, bidder must, except with the approval of the owner for good cause shown, use the listed entities to perform the work for which they are listed.

8. If bidder is awarded the contract, bidder will not be allowed to substitute another entity as subcontractor in place of a subcontractor listed in Section 7 of the Bid except for one or more of the reasons allowed by the SC Code of Laws.

9. Bidder's failure to insert a name for each listed specialty subcontractor will render the Bid non-responsive.

SE-330 – LUMP SUM BID
BID FORM

§ 8. LIST OF MANUFACTURERS, MATERIAL SUPPLIERS, AND SUBCONTRACTORS OTHER THAN SUBCONTRACTORS LISTED IN SECTION 7 ABOVE *(FOR INFORMATION ONLY):* Pursuant to instructions in the Invitation for Bids, if any, Bidder will provide to Owner upon the Owner's request and within 24 hours of such request, a listing of manufacturers, material suppliers, and subcontractors, other than those listed in Section 7 above, that Bidder intends to use on the project. Bidder acknowledges and agrees that this list is provided for purposes of determining responsibility and not pursuant to the subcontractor listing requirements of SC Code Ann § 11-35-3020(b)(i).

§ 9. TIME OF CONTRACT PERFORMANCE AND LIQUIDATED DAMAGES

a. CONTRACT TIME: Bidder agrees that the Date of Commencement of the Work shall be established in a Notice to Proceed to be issued by the Owner. Bidder agrees to substantially complete the Work within **300** calendar days from the Date of Commencement, subject to adjustments as provided in the Contract Documents.

b. LIQUIDATED DAMAGES: Bidder further agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the sum of $250.00for each calendar day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted time for Substantial Completion as provided in the Contract Documents. This sum is intended by the parties as the predetermined measure of compensation for actual damages, not as a penalty for nonperformance.

§ 10. AGREEMENTS

a. Bidder agrees that this bid is subject to the requirements of the law of the State of South Carolina.

b. Bidder agrees that at any time prior to the issuance of the Notice to Proceed for this Project, this Project may be canceled for the convenience of, and without cost to, the State.

c. Bidder agrees that neither the State of South Carolina nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the Project canceled for any reason prior to the issuance of the Notice to Proceed.

§ 11. ELECTRONIC BID BOND

By signing below, the Principal is affirming that the identified electronic bid bond has been executed and that the Principal and Surety are firmly bound unto the State of South Carolina under the terms and conditions of the AIA Document A310, Bid Bond, included in the Bidding Documents.

Electronic Bid Bond Number: _____

Signature and Title: _____

SE-330 – LUMP SUM BID
BID FORM

BIDDER'S TAXPAYER IDENTIFICATION

FEDERAL EMPLOYER'S IDENTIFICATION NUMBER:_____

OR

SOCIAL SECURITY NUMBER:_____

CONTRACTOR'S CLASSIFICATIONS AND SUBCLASSIFICATIONS WITH LIMITATIONS

Classification(s)& Limits: _____

Subclassification(s) & Limits:_____

SC Contractor's License Number(s):_____

BY SIGNING THIS BID, THE PERSON SIGNING REAFFIRMS ALL REPRESENTATIONS AND CERTIFICATIONS MADE BY BOTH THE PERSON SIGNING AND THE BIDDER, INCLUDING WITHOUT LIMITATION, THOSE APPEARING IN ARTICLE 2 OF THE INSTRUCTIONS TO BIDDER. THE INVITATION FOR BIDS, AS DEFINED IN THE INSTRUCTIONS TO BIDDERS, IS EXPRESSLY INCORPORATE BY REFERENCE.

SIGNATURE

BIDDER'S LEGAL NAME: _____

ADDRESS: _____

_____

BY:_____ **DATE:**_____
(Signature)

TITLE:_____

TELEPHONE:_____

EMAIL: _____

SECTION AIA A101 – 2007

Standard Form of Agreement Between Owner and Contractor

The Standard Form of Agreement Between Owner and Contractor, AIA Document A-101, 2007 Edition, shall be the form of Agreement, and is incorporated into the Contract documents by reference.

Copies of the Standard Form of Agreement Between Owner and Contractor, AIA Document A-101, 2007 Edition, are available for examination at the office of the Architect. Copies Standard Form of Agreement Between Owner and Contractor, may also be obtained from The American Institute of Architects, 1735 New York Avenue N.W., Washington, DC 20006, or from local AIA offices.

End of Section AIA A101-2007

OSE FORM 00501

Rev. 12/02/2013

STANDARD MODIFICATIONS TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

OWNER: University of South Carolina
PROJECT NUMBER: H27-6105-MJ-B
PROJECT NAME: Athletic Village Improvements - New Soccer Building

1. STANDARD MODIFICATIONS TO AIA A101-2007

1.1. These Standard Modifications amend or supplement the *Standard Form of Agreement Between Owner and Contractor* (AIA Document A101-2007) and other provisions of Bidding and Contract Documents as indicated below.

1.2. All provisions of A101-2007, which are not so amended or supplemented, remain in full force and effect.

2. MODIFICATIONS TO A101

2.1. *Insert the following at the end of Article 1:*

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

2.2. *Delete Section 3.1 and substitute the following:*

3.1 The Date of Commencement of the Work shall be the date fixed in a Notice to Proceed issued by the Owner. The Owner shall issue the Notice to Proceed to the Contractor in writing, no less than seven days prior to the Date of Commencement. Unless otherwise provided elsewhere in the contract documents, and provided the contractor has secured all required insurance and surety bonds, the contractor may commence work immediately after receipt of the Notice to Proceed.

2.3. *Delete Section 3.3 and substitute the following:*
3.3 The Contract Time shall be measured from the Date of Commencement as provided in Section 9(a) of the Bid Form (SE-330) for this Project. Contractor agrees that if the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, the Owner shall be entitled to withhold or recover from the Contractor liquidated damages in the amounts set forth in Section 9(b) of the Bid Form (SE-330, subject to adjustments of this Contract Time as provided in the Contract Documents.

2.4. *In Section 5.1.1, insert the words "and Owner" after the phrase "Payment submitted to the Architect."*

2.5. *Delete Section 5.1.3 and substitute the following:*

5.1.3 The Owner shall make payment of the certified amount to the Contractor not later than 21 days after receipt of the Application for Payment.

2.6. *In Section 5.1.6, Insert the following after the phrase "Subject to other provisions of the Contract Documents":*

and subject to Title 12, Chapter 8, Section 550 of the South Carolina Code of Laws, as amended (Withholding Requirements for Payments to Non-Residents)

In the spaces provided in Sub-Sections 1 and 2 for inserting the retainage amount, insert "three and one-half percent (3.5%)."

2.7. *In Section 5.1.8, delete the word "follows" and the colon and substitute the following:*

set forth in S.C. Code Ann. § 11-35-3030(4).

2.8. *In Section 5.1.9, delete the words "Except with the Owner's prior approval, the" before the word " Contractor."*

2.9. *In Section 5.2.2, delete the number 30 and substitute the number 21, delete everything following the words "Certificate for Payment" and place a period at the end of the resulting sentence.*

2.10. *Delete the language of Sections 6.1 and 6.2 and substitute the word "Reserved" for the deleted language of each Section .*

2.11. *Delete the language of Section 8.2 and substitute the word "Reserved."*

2.12. *In Section 8.3, make the word "Representative" in the title plural, delete everything following the title, and substitute the following:*

8.3.1 Owner designates the individual listed below as its Senior Representative ("Owner's Senior Representative"), which individual has the responsibility for and, subject to Section 7.2.1 of the General Conditions, the authority to resolve disputes under Section 15.6 of the General Conditions:

Name: Mr. Tom Opal
Title: Sr. Project Manager
Address: 743 Greene Street, Columbia, SC 29208
Telephone: (803) 777-8739 **FAX:** _____
Email: TNOPAL@fmc.sc.edu

8.3.2 Owner designates the individual listed below as its Owner's Representative, which individual has the authority and responsibility set forth in Section 2.1.1 of the General Conditions:

Name: Ms. Ann Derrick
Title: Project Manager
Address: 743 Greene Street, Columbia, SC 29208
Telephone: (803) 777-8739 **FAX:** _____
Email: ADERRICK@fmc.sc.edu

2.13. *In Section 8.4, make the word "Representative" in the title plural, delete everything following the title, and substitute the following:*

8.4.1 Contractor designates the individual listed below as its Senior Representative ("Contractor's Senior Representative"), which individual has the responsibility for and authority to resolve disputes under Section 15.6 of the General Conditions:

Name: _____
Title: _____
Address: _____
Telephone: _____ **FAX:** _____
Email: _____

8.4.2 Contractor designates the individual listed below as its Contractor's Representative, which individual has the authority and responsibility set forth in Section 3.1.1 of the General Conditions:

Name: _____
Title: _____
Address: _____
Telephone: _____ **FAX:** _____
Email: _____

2.14. *Add the following Section 8.6.1:*

8.6.1 The Architect's representative:

Name: Clint Burdett
Title: Project Architect
Address: 1812 Lincoln Street, Columbia, SC 29201
Telephone: (803) 252-2400 **FAX:** (803) 252- 1620
Email: _____

2.15. *In Section 9.1.7, Sub-Section 2, list the following documents in the space provided for listing documents:*

Invitation for Construction Bids (SE-310)
Instructions to Bidders (AIA Document A701-1997)
Standard Supplemental Instructions to Bidders (OSE Form 00201)
Contractor's Bid (Completed SE-330)
Notice of Intent to Award (Completed SE-370)
Certificate of procurement authority issued by the SC Budget & Control Board

2.16. *In Article 10, delete everything after the first sentence.*

END OF DOCUMENT

SSECTION 00701

GENERAL CONDITIONS OF THE CONTRACT

The General Conditions of the Contract for Construction, AIA Document A-201, 2007 Edition, shall be the form of General Conditions, and is incorporated into the Contract Documents by this reference.

Copies of the General Conditions as amended by at the office of the architect. Copies of the General Conditions may also be obtained from The American Institute of Architects, 1735 New York Avenue N.W., Washington, DC 20006, or from the local AIA offices.

END OF SECTION 007010

OSE FORM 00811

Rev. 07/14/2014

STANDARD SUPPLEMENTARY CONDITIONS

OWNER: UNIVERSITY OF SOUTH CAROLINA
PROJECT NUMBER: H27-6105-MJ-B
PROJECT NAME: ATHLETIC VILLAGE IMPROVEMENTS - NEW SOCCER BUILDING

1 GENERAL CONDITIONS

The *General Conditions of the Contract for Construction,* AIA Document A201, 2007 Edition, Articles 1 through 15 inclusive, is a part of this Contract and is incorporated as fully as if herein set forth. For brevity, AIA Document A201 is also referred to in the Contract Documents collectively as the "General Conditions."

2 STANDARD SUPPLEMENTARY CONDITIONS

2.1 The following supplements modify, delete and/or add to the General Conditions. Where any portion of the General Conditions is modified or any paragraph, Section or clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of the General Conditions shall remain in effect.

2.2 Unless otherwise stated, the terms used in these Standard Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

3 MODIFICATIONS TO A201-2007

3.1 *Insert the following at the end of Section 1.1.1:*

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

3.2 *Delete the language of Section 1.1.8 and substitute the word "Reserved."*

3.3 *Add the following Section 1.1.9:*

1.1.9 NOTICE TO PROCEED
Notice to Proceed is a document issued by the Owner to the Contractor, with a copy to the Architect, directing the Contractor to begin prosecution of the Work in accordance with the requirements of the Contract Documents. The Notice to Proceed shall fix the date on which the Contract Time will commence.

3.4 *Insert the following at the end of Section 1.2.1:*

In the event of patent ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of Work, or 2) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation.

3.5 *Delete Section 1.5.1 and substitute the following:*

1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as a violation of the Architect's or Architect's consultants' reserved rights.

3.6 *Delete Section 2.1.1 and substitute the following:*

2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization, except as provided in Section 7.1.2. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's Representative. [Reference § 8.2 of the Agreement.]

3.7 *Delete Section 2.1.2 and substitute the following:*

2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to post Notice of Project Commencement pursuant to Title 29, Chapter 5, Section 23 of the South Carolina Code of Laws, as amended..

3.8 *Delete Section 2.2.3 and substitute the following:*

2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. Subject to the Contractor's obligations, including those in Section 3.2, the Contractor shall be entitled to rely on the accuracy of information furnished by the Owner pursuant to this Section but shall exercise proper precautions relating to the safe performance of the Work.

3.9 *Replace the period at the end of the last sentence of Section 2.2.4 with a semicolon and insert the following after the inserted semicolon:*

"however, the Owner does not warrant the accuracy of any such information requested by the Contractor that is not otherwise required of the Owner by the Contract Documents. Neither the Owner nor the Architect shall be required to conduct investigations or to furnish the Contractor with any information concerning subsurface characteristics or other conditions of the area where the Work is to be performed beyond that which is provide in the Contract Documents."

3.10 *Delete Section 2.2.5 and substitute the following:*

2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor with ten copies of the Contract Documents. The Contractor may make reproductions of the Contract Documents pursuant to Section 1.5.2. All copies of the drawings and specifications, except the Contractor's record set, shall be returned or suitably accounted for to the Owner, on request, upon completion of the Work.

3.11 *Add the following Sections 2.2.6 and 2.2.7:*

2.2.6 The Owner assumes no responsibility for any conclusions or interpretation made by the Contractor based on information made available by the Owner.

2.2.7 The Owner shall obtain, at its own cost, general building and specialty inspection services as required by the Contract Documents. The Contractor shall be responsible for payment of any charges imposed for reinspections.

3.12 *Delete Section 2.4 and substitute the following:*

2.4 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect, including but not limited to providing necessary resources, with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Directive shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

3.13 *Insert the following at the end of Section 3.2.1:*

The Contractor acknowledges that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Owner, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Owner.

3.14 *In the third sentence of Section 3.2.4, insert the word "latent" before the word "errors."*

3.15 *In the last sentence of Section 3.3.1, insert the words "by the Owner in writing" after the word "instructed."*

3.16 *Delete the third sentence of Section 3.5 and substitute the following sentences:*

Work, materials, or equipment not conforming to these requirements shall be considered defective. Unless caused by the Contractor or a subcontractor at any tier, the Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage.

3.17 *Insert the following at the end of Section 3.6:*

The Contractor shall comply with the requirements of Title 12, Chapter 9 of the South Carolina Code of Laws, as amended, regarding withholding tax for nonresidents, employees, contractors and subcontractors.

3.18 *In Section 3.7.1, delete the words "the building permit as well as for other" and insert the following sentence at the end of this section:*

Pursuant to Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, no local general or specialty building permits are required for state buildings.

3.19 *Delete the last sentence of Section 3.7.5 and substitute the following:*

Adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 7.3.3.

3.20 *Delete the last sentence of Section 3.8.2.3 and substitute the following:*

The amount of the Change Order shall reflect the difference between actual costs, as documented by invoices, and the allowances under Section 3.8.2.1.

3.21 *In Section 3.9.1, insert a comma after the word "superintendent" in the first sentence and insert the following after the inserted comma:*

acceptable to the Owner,

3.22 *Delete Section 3.9.2 and substitute the following:*

3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner the name and qualifications of a proposed superintendent. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to the proposed superintendent or (2) that the

Owner requires additional time to review. Failure of the Owner to reply within the 14-day period shall constitute notice of no reasonable objection.

3.23 *After the first sentence in Section 3.9.3, insert the following sentence:*

The Contractor shall notify the Owner, in writing, of any proposed change in the superintendent, including the reason therefore, prior to making such change.

3.24 *Delete Section 3.10.3 and substitute the following:*

3.10.3 Additional requirements, if any, for the constructions schedule are as follows:
(Check box if applicable to this Contract))

☐ The construction schedule shall be in a detailed precedence-style critical path management (CPM) or primavera-type format satisfactory to the Owner and the Architect that shall also (1) provide a graphic representation of all activities and events that will occur during performance of the work; (2) identify each phase of construction and occupancy; and (3) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as "Milestone Dates"). Upon review and acceptance by the Owner and the Architect of the Milestone Dates, the construction schedule shall be deemed part of the Contract Documents and attached to the Agreement as Exhibit "A." If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner and the Architect and resubmitted for acceptance. The Contactor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. Whenever the approved construction schedule no longer reflects actual conditions and progress of the work or the Contract Time is modified in accordance with the terms of the Contract Documents, the Contractor shall update the accepted construction schedule to reflect such conditions. In the event any progress report indicates any delays, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment in the Contract Time, any Milestone Date, or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to Change Order.

3.25 *Add the following Section 3.10.4:*

3.10.4 Owner's review and acceptance of Contractor's schedule is not conducted for the purpose of either determining its accuracy and completeness or approving the construction means, methods, techniques, sequences or procedures. The Owner's approval shall not relieve the Contractor of any obligations. Unless expressly addressed in a Modification, the Owner's approval of a schedule shall not change the Contract Time.

3.26 *Add the following Section 3.12.5.1:*

3.12.5.1 The fire sprinkler shop drawings shall be prepared by a licensed fire sprinkler contractor and shall accurately reflect actual conditions affecting the required layout of the fire sprinkler system. The fire sprinkler contractor shall certify the accuracy of his shop drawings prior to submitting them for review and approval. The fire sprinkler shop drawings shall be reviewed and approved by the Architect's engineer of record who, upon approving the sprinkler shop drawings will submit them to the State Fire Marshal or other authorities having jurisdiction for review and approval. The Architect's engineer of record will submit a copy of the State Fire Marshal's approval letter to the Contractor, Architect, and OSE. Unless authorized in writing by OSE, neither the Contractor nor subcontractor at any tier shall submit the fire sprinkler shop drawings directly to the State Fire Marshal or other authorities having jurisdiction for approval.

3.27 *In the fourth sentence of Section 3.12.10, after the comma following the words "licensed design professional," insert the following:*

who shall comply with reasonable requirements of the Owner regarding qualifications and insurance and

3.28 *In Section 3.13, insert the section number "3.13.1" before the before the opening words "The Contractors shall."*

3.29 Add the following Sections 3.13.2 and 3.13.3:

3.13.2 Protection of construction materials and equipment stored at the Project site from weather, theft, vandalism, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall perform the work in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials, and equipment likely to cause hazardous conditions.

3.13.3 The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner.

3.30 *In the first sentence of Section 3.18.1, after the parenthetical "…(other than the Work itself),…" and before the word "…but...", insert the following:*

including loss of use resulting therefrom,

3.31 *Delete Section 4.1.1 and substitute the following:*

4.1.1 The Architect is that person or entity identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

3.32 *Insert the following at the end of Section 4.2.1:*

Any reference in the Contract Documents to the Architect taking action or rendering a decision with a "reasonable time" is understood to mean no more than fourteen days, unless otherwise specified in the Contract Documents or otherwise agreed to by the parties.

3.33 *Delete the first sentence of Section 4.2.2 and substitute the following:*

The Architect will visit the site as necessary to fulfill its obligation to the Owner for inspection services, if any, and, at a minimum, to assure conformance with the Architect's design as shown in the Contract Documents and to observe the progress and quality of the various components of the Contractor's Work, and to determine if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents.

3.34 *Delete the first sentence of Section 4.2.3 and substitute the following*:

On the basis of the site visits, the Architect will keep the Owner informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work.

3.35 *In Section 4.2.5, after the words "evaluations of the" and before the word "Contractor's," insert the following:*

Work completed and correlated with the

3.36 *Delete the first sentence of Section 4.2.11 and substitute the following:*

4.2.11 The Architect will, in the first instance, interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. Upon receipt of such request, the Architect will promptly provide the non-requesting party with a copy of the request.

3.37 *Insert the following at the end of Section 4.2.12:*

If either party disputes the Architects interpretation or decision, that party may proceed as provided in Article 15. The Architect's interpretations and decisions may be, but need not be, accorded any deference in any review conducted pursuant to law or the Contract Documents.

3.38 *Delete Section 4.2.14 and substitute the following:*

The Architect will review and respond to requests for information about the Contract Documents so as to avoid delay to the construction of the Project. The Architect's response to such requests will be made in writing with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information. Any response to a request for information must be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. Unless issued pursuant to a Modification, supplemental Drawings or Specifications will not involve an adjustment to the Contract Sum or Contract Time.

3.39 *Delete Section 5.2.1 and substitute the following:*

5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within fourteen days after posting of the Notice of Intent to Award the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (excluding Listed Subcontractors but including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to any such proposed person or entity. Failure of the Owner to reply within the 14 day period shall constitute notice of no reasonable objection.

3.40 *Delete Section 5.2.2 and substitute the following:*

5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection. The Owner shall not direct the Contractor to contract with any specific individual or entity for supplies or services unless such supplies and services are necessary for completion of the Work and the specified individual or entity is the only source of such supply or services.

3.41 *In the first sentence of Section 5.2.3, delete the words "…or Architect…" in the two places they appear.*

3.42 *Delete the words "…or Architect…" in the in the first sentence of Section 5.2.4 and insert the following sentence at the end of Section 5.2.4:*

The Contractor's request for substitution must be made to the Owner in writing accompanied by supporting information.

3.43 *Add the following Section 5.2.5:*

5.2.5 A Subcontractor identified in the Contractor's Bid in response the specialty subcontractor listing requirements of Section 7 of the Bid Form (SE-330) may only be substituted in accordance with and as permitted by the provisions of Title 11, Chapter 35, Section 3021 of the South Carolina Code of Laws, as amended. A proposed substitute for a Listed Subcontractor shall be subject to the Owner's approval as set forth is Section 5.2.3.

3.44 *In Section 5.3, delete everything following the heading "SUBCONTRACTUAL RELATIONS" and insert the following Sections 5.3.1, 5.3.2, 5.3.3, and 5.3.4:*

5.3.1 By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not

prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise herein or in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.2 Without limitation on the generality of Section 5.3.1, each Subcontract agreement and each Sub-subcontract agreement shall include, and shall be deemed to include, the following Sections of these General Conditions: 3.2, 3.5, 3.18, 5.3, 5.4, 6.2.2, 7.3.3, 7.5, 7.6, 13.1, 13.12, 14.3, 14.4, and 15.1.6.

§ 5.3.3 Each Subcontract Agreement and each Sub-subcontract agreement shall exclude, and shall be deemed to exclude, Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of these General Conditions. In the place of these excluded sections of the General Conditions, each Subcontract Agreement and each Sub-subcontract may include Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of AIA Document A201-2007, Conditions of the Contract, as originally issued by the American Institute of Architects.

§ 5.3.4 The Contractor shall assure the Owner that all agreements between the Contractor and its Subcontractor incorporate the provisions of Subparagraph 5.3.1 as necessary to preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the work to be performed by Subcontractors so that the subcontracting thereof will not prejudice such rights. The Contractor's assurance shall be in the form of an affidavit or in such other form as the Owner may approve. Upon request, the Contractor shall provide the Owner or Architect with copies of any or all subcontracts or purchase orders.

3.45 *Delete the last sentence of Section 5.4.1.*

3.46 *Add the following Sections 5.4.4, 5.4.5 and 5.4.6:*

§ 5.4.4 Each subcontract shall specifically provide that the Owner shall only be responsible to the subcontractor for those obligations of the Contractor that accrue subsequent to the Owner's exercise of any rights under this conditional assignment.

§ 5.4.5 Each subcontract shall specifically provide that the Subcontractor agrees to perform portions of the Work assigned to the Owner in accordance with the Contract Documents.

§ 5.4.6 Nothing in this Section 5.4 shall act to reduce or discharge the Contractor's payment bond surety's obligations to claimants for claims arising prior to the Owner's exercise of any rights under this conditional assignment.

3.47 *Delete the language of Section 6.1.4 and substitute the word "Reserved."*

3.48 *Insert the following at the end of Section 7.1.2:*

If the amount of a Modification exceeds the limits of the Owner's Construction Change Order Certification (reference Section 9.1.7.2 of the Agreement), then the Owner's agreement is not effective, and Work may not proceed, until approved in writing by the Office of State Engineer.

3.49 *Delete Section 7.2.1 and substitute the following:*

7.2.1 A Change Order is a written instrument prepared by the Architect (using State Form SE-480 "Construction Change Order") and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;

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

3.50 *Add the following Sections 7.2.2, 7.2.3, 7.2.4, and 7.2.5:*

7.2.2 If a Change Order provides for an adjustment to the Contract Sum, the adjustment must be calculated in accordance with Section 7.3.3.

7.2.3 At the Owner's request, the Contractor shall prepare a proposal to perform the work of a proposed Change Order setting forth the amount of the proposed adjustment, if any, in the Contract Sum; and the extent of the proposed adjustment, if any, in the Contract Time. Any proposed adjustment in the Contract sum shall be prepared in accordance with Section 7.2.2. The Owner's request shall include any revisions to the Drawings or Specifications necessary to define any changes in the Work. Within fifteen days of receiving the request, the Contractor shall submit the proposal to the Owner and Architect along with all documentation required by Section 7.6.

7.2.4 If the Contractor requests a Change Order, the request shall set forth the proposed change in the Work and shall be prepared in accordance with Section 7.2.3. If the Contractor requests a change to the Work that involves a revision to either the Drawings or Specifications, the Contractor shall reimburse the Owner for any expenditures associated with the Architects' review of the proposed revisions, except to the extent the revisions are accepted by execution of a Change Order.

7.2.5 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, any adjustments to the Contract Sum or the Contract Time.

3.51 *Delete 7.3.3 and substitute the following:*

7.3.3 PRICE ADJUSTMENTS
§ 7.3.3.1 If any Modification, including a Construction Change Directive, provides for an adjustment to the Contract Sum, the adjustment shall be based on whichever of the following methods is the most valid approximation of the actual cost to the contractor, with overhead and profit as allowed by Section 7.5:

.1 Mutual acceptance of a lump sum;
.2 Unit prices stated in the Contract Documents, except as provided in Section 7.3.4, or subsequently agreed upon;
.3 Cost attributable to the events or situations under applicable clauses with adjustment of profits or fee, all as specified in the contract, or subsequently agreed upon by the parties, or by some other method as the parties may agree; or
.4 As provided in Section 7.3.7.

§ 7.3.3.2 Consistent with Section 7.6, costs must be properly itemized and supported by substantiating data sufficient to permit evaluation before commencement of the pertinent performance or as soon after that as practicable. All costs incurred by the Contractor must be justifiably compared with prevailing industry standards. Except as provided in Section 7.5, all adjustments to the Contract Price shall be limited to job specific costs and shall not include indirect costs, overhead, home office overhead, or profit.

3.52 *Delete Section 7.3.7 and substitute the following:*

7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall make an initial determination, consistent with Section 7.3.3, of the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in Section 7.5. In such case, and also under Section 7.3.3.1.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

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

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

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

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

3.53 *Delete Section 7.3.8 and substitute the following:*

7.3.8 Using the percentages stated in Section 7.5, any adjustment to the Contract Sum for deleted work shall include any overhead and profit attributable to the cost for the deleted Work.

3.54 *Add the following Sections 7.5 and 7.6:*

7.5 AGREED OVERHEAD AND PROFIT RATES

7.5.1 For any adjustment to the Contract Sum for which overhead and profit may be recovered, other than those made pursuant to Unit Prices stated in the Contract Documents, the Contractor agrees to charge and accept, as full payment for overhead and profit, the following percentages of costs attributable to the change in the Work. The percentages cited below shall be considered to include all indirect costs including, but not limited to: field and office managers, supervisors and assistants, incidental job burdens, small tools, and general overhead allocations. The allowable percentages for overhead and profit are as follows:

.1 To the Contractor for work performed by the Contractor's own forces, 17% of the Contractor's actual costs.

.2 To each Subcontractor for work performed by the Subcontractor's own forces, 17% of the subcontractor's actual costs.

.3 To the Contractor for work performed by a subcontractor, 10% of the subcontractor's actual costs (not including the subcontractor's overhead and profit).

7.6 PRICING DATA AND AUDIT

§ 7.6.1 Cost or Pricing Data.

Upon request of the Owner or Architect, Contractor shall submit cost or pricing data prior to execution of a Modification which exceeds $500,000. Contractor shall certify that, to the best of its knowledge and belief, the cost or pricing data submitted is accurate, complete, and current as of a mutually determined specified date prior to the date of pricing the Modification. Contractor's price, including profit, shall be adjusted to exclude any significant sums by which such price was increased because Contractor furnished cost or pricing data that was inaccurate, incomplete, or not current as of the date specified by the parties. Notwithstanding Subparagraph 9.10.4, such adjustments may be made after final payment to the Contractor.

§ 7.6.2 Cost or pricing data means all facts that, as of the date specified by the parties, prudent buyers and sellers would reasonably expect to affect price negotiations significantly. Cost or pricing data are factual, not judgmental; and are verifiable. While they do not indicate the accuracy of the prospective contractor's judgment about estimated future costs or projections, they do include the data forming the basis for that judgment. Cost or pricing data are more than historical accounting data; they are all the facts that can be reasonably expected to contribute to the soundness of estimates of future costs and to the validity of determinations of costs already incurred.

§ 7.6.3 Records Retention.

As used in Section 7.6, the term "records" means any books or records that relate to cost or pricing data that Contractor is required to submit pursuant to Section 7.6.1. Contractor shall maintain records for three years from the date of final payment, or longer if requested by the chief procurement officer. The Owner may audit Contractor's records at reasonable times and places.

3.55 Delete Section 8.2.2 and substitute the following:

8.2.2 The Contractor shall not knowingly commence operations on the site or elsewhere prior to the effective date of surety bonds and insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such surety bonds or insurance.

3.56 *Delete Section 8.3.1 and substitute the following:*

8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the control of the Contractor and any subcontractor at any tier; or by delay authorized by the Owner pending dispute resolution; or by other causes that the Architect determines may justify delay, then to the extent such delay will prevent the Contractor from achieving Substantial Completion within the Contract Time and provided the delay (1) is not caused by the fault or negligence of the Contractor or a subcontractor at any tier and (2) is not due to unusual delay in the delivery of supplies, machinery, equipment, or services when such supplies, machinery, equipment, or services were obtainable from other sources in sufficient time for the Contractor to meet the required delivery, the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

3.57 *Insert the following at the end of Section 9.1:*

All changes to the Contract Sum shall be adjusted in accordance with Section 7.3.3.

3.58 *Delete Section 9.2 and substitute the following:*

9.2 SCHEDULE OF VALUES

9.2.1 The Contractor shall submit to the Architect, within ten days of full execution of the Agreement, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. As requested by the Architect, the Contractor and each Subcontractor shall prepare a trade payment breakdown for the Work for which each is responsible, such breakdown being submitted on a uniform standardized format approved by the Architect and Owner. The breakdown shall be divided in detail, using convenient units, sufficient to accurately determine the value of completed Work during the course of the Project. The Contractor shall update the schedule of values as required by either the Architect or Owner as necessary to reflect:

- **.1** the description of Work (listing labor and material separately);
- **.2** the total value;
- **.3** the percent and value of the Work completed to date;
- **.4** the percent and value of previous amounts billed; and
- **.5** the current percent completed and amount billed.

9.2.2 Any schedule of values or trade breakdown that fails to include sufficient detail, is unbalanced, or exhibits "front-loading" of the value of the Work shall be rejected. If a schedule of values or trade breakdown is used as the basis for payment and later determined to be inaccurate, sufficient funds shall be withheld from future Applications for Payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Work.

3.59 *Delete Section 9.3.1 and substitute the following:*

Monthly, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2., for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require (such as copies of requisitions from Subcontractors and material suppliers) and shall reflect retainage and any other adjustments provided in Section 5 of the Agreement. If required by the Owner or Architect, the Application for Payment shall be accompanied by a current construction schedule.

3.60 In Section 9.3.2, add the following words to the end of the second sentence:

provided such materials or equipment will be subsequently incorporated in the Work

Insert the following at the end of Section 9.3.2:

The Contractor shall 1) protect such materials from diversion, vandalism, theft, destruction, and damage, 2) mark such materials specifically for use on the Project, and 3) segregate such materials from other materials at the storage facility. The Architect and the Owner shall have the right to make inspections of the storage areas at any time.

3.61 *In Section 9.4.2, in the first sentence, after the words "Work has progressed to the point indicated," insert the following:*

in both the Application for Payment and, if required to be submitted by the Contractor, the accompanying current construction schedule

In the last sentence, delete the third item starting with "(3) reviewed copies" and ending with "Contractor's right to payment,"

3.62 *In Section 9.5.1, in the first sentence, delete the word "may" after the opening words "The Architect" and substitute the word "shall."*

In Section 9.5.1, insert the following sentence after the first sentence:

The Architect shall withhold a Certificate of Payment if the Application for Payment is not accompanied by the current construction schedule required by Section 3.10.1.

3.63 *In Section 9.6.2,* d*elete the word "The…" at the beginning of the first sentence and substitute the following:*

Pursuant to Chapter 6 of Title 29 of the South Carolina Code of Laws, as amended, the

3.64 *Delete Section 9.7 and substitute following:*

9.7 FAILURE OF PAYMENT
If the Architect does not issue a Certificate for Payment to the Owner, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the time established in the Contract Documents the amount certified by the Architect or awarded by a final dispute resolution order, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased, in accordance with the provisions of Section 7.3.3, by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

3.65 *Insert the following words at the end of the sentence in Section 9.8.1:*

and when all required occupancy permits, if any, have been issued and copies of same have been delivered to the Owner.

3.66 *In Section 9.8.2, insert the word "written" after the word "comprehensive" and before the word "list."*

3.67 *Delete Section 9.8.3 and substitute the following:*

9.8.3.1 Upon receipt of the Contractor's list, the Architect, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, to determine whether the Work or designated portion thereof is substantially complete. The Contractor shall furnish access for the inspection and testing as provided in this Contract. The inspection shall include a

demonstration by the Contractor that all equipment, systems and operable components of the Work function properly and in accordance with the Contract Documents. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. If more than one Substantial Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner's option, the costs may be deducted from payments due to the Contractor.

9.8.3.2 If the Architect and Owner concur in the Contractor's assessment that the Work or a portion of the Work is safe to occupy, the Owner and Contractor may arrange for a Certificate of Occupancy Inspection by OSE. The Owner, Architect, and Contractor shall be present at OSE's inspection. Upon verifying that the Work or a portion of the Work is substantially complete and safe to occupy, OSE will issue, as appropriate, a Full or Partial Certificate of Occupancy.

3.68 *In the second sentence of Section 9.8.5, delete the words "and consent of surety, if any."*

3.69 *In the first sentence of Section 9.9.1, delete the words "Section 11.3.1.5"and substitute the words "Section 11.3.1.3."*

3.70 *Delete Section 9.10.1 and substitute the following:*

9.10.1 Unless the parties agree otherwise in the Certificate of Substantial Completion, the Contractor shall achieve Final Completion no later than thirty days after Substantial Completion. Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. If more than one Final Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner's option, the costs may be deducted from payments due to the Contractor. If the Contractor does not achieve final completion within thirty days after Substantial Completion or the timeframe agreed to by the parties in the Certificate of Substantial Completion, whichever is greater, the Contractor shall be responsible for any additional Architectural fees resulting from the delay.

3.71 *Delete the first sentence of Section 9.10.2 and substitute the following:*

Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, (6) required Training Manuals, (7) equipment Operations and Maintenance Manuals, (8) any certificates of testing, inspection or approval required by the Contract Documents and not previously provided (9) all warranties and guarantees required under or pursuant to the Contract Documents, and (10) one copy of the Documents required by Section 3.11.

3.72 Delete the first sentence of Section 9.10.3 and substitute the following:

If, after Substantial Completion of the Work, final completion thereof is delayed 60 days through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted.

3.73 *Delete Section 9.10.5 and substitute the following:*

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

3.74 Add the following Section 9.10.6:

9.10.6 If OSE has not previously issued a Certificate of Occupancy for the entire Project, the Parties shall arrange for a representative of OSE to participate in the Final Completion Inspection. Representatives of the State Fire Marshal's Office and other authorities having jurisdiction may be present at the Final Completion Inspection or otherwise inspect the completed Work and advise the Owner whether the Work meets their respective requirements for the Project.

3.75 *Delete Section 10.3.1 and substitute the following:*

10.3.1 If the Contractor encounters a hazardous material or substance which was not discoverable as provided in Section 3.2.1 and not required by the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons or serious loss to real or personal property resulting from such material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. Hazardous materials or substances are those hazardous, toxic, or radioactive materials or substances subject to regulations by applicable governmental authorities having jurisdiction, such as, but not limited to, the S.C. Department of Health and Environmental Control, the U.S. Environmental Protection Agency, and the U.S. Nuclear Regulatory Commission.

3.76 *Insert the following at the end of Section 10.3.2:*

In the absence of agreement, the Architect will make an interim determination regarding any delay or impact on the Contractor's additional costs. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15. Any adjustment in the Contract Sum shall be determined in accordance with Section 7.3.3.

3.77 *Delete Section 10.3.3 and substitute the following:*

10.3.3 The Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (a) the Owner causes remedial work to be performed that results in the absence of hazardous materials or substances; (b) the Owner and the Contractor, by written agreement, decide to resume performance of the Work; or (c) the Work may safely and lawfully proceed, as determined by an appropriate governmental authority or as evidenced by a written report to both the Owner and the Contractor, which is prepared by an environmental engineer reasonably satisfactory to both the Owner and the Contractor.

3.78 *In Section 10.3.5, delete the word "The" at the beginning of the sentence and substitute the following:*

In addition to its obligations under Section 3.18, the

3.79 *Delete the language of Section 10.3.6 and substitute the word "Reserved."*

3.80 *Insert the following at the end of Section 10.4:*

The Contractor shall immediately give the Architect notice of the emergency. This initial notice may be oral followed within five days by a written notice setting forth the nature and scope of the emergency. Within fourteen days of the start of the emergency, the Contractor shall give the Architect a written estimate of the cost and probable effect of delay on the progress of the Work.

3.81 *Delete 11.1.2 and substitute the following:*

11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified below or required by law, whichever coverage is greater. Coverages shall be written on an occurrence basis and shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

(1) COMMERCIAL GENERAL LIABILITY:
- **(a)** General Aggregate (per project) $1,000,000
- **(b)** Products/Completed Operations $1,000,000
- **(c)** Personal and Advertising Injury $1,000,000
- **(d)** Each Occurrence $1,000,000
- **(e)** Fire Damage (Any one fire) $50,000
- **(f)** Medical Expense (Any one person) $5,000

(2) BUSINESS AUTO LIABILITY (including All Owned, Non-owned, and Hired Vehicles):
- **(a)** Combined Single Limit $1,000,000

(3) WORKER'S COMPENSATION:
- **(a)** State Statutory
- **(b)** Employers Liability ..... $100,000 Per Acc.
  ..... $500,000 Disease, Policy Limit
  ..... $100,000 Disease, Each Employee

In lieu of separate insurance policies for Commercial General Liability, Business Auto Liability, and Employers Liability, the Contractor may provide an umbrella policy meeting or exceeding all coverage requirements set forth in this Section 11.1.2. The umbrella policy limits shall not be less than $3,000,000.

3.82 *Delete Section 11.1.3 and substitute the following:*

11.1.3 Prior to commencement of the Work, and thereafter upon replacement of each required policy of insurance, Contractor shall provide to the Owner a written endorsement to the Contractor's general liability insurance policy that:

(i) names the Owner as an additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations;
(ii) provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall have effect unless all additional insureds have been given at least ten (10) days prior written notice of cancellation for non-payment of premiums and thirty (30) days prior written notice of cancellation for any other reason; and
(iii) provides that the Contractor's liability insurance policy shall be primary, with any liability insurance of the Owner as secondary and noncontributory.

Prior to commencement of the Work, and thereafter upon renewal or replacement of each required policy of insurance, Contractor shall provide to the Owner a signed, original certificate of liability insurance (ACORD 25). Consistent with this Section 11.1, the certificate shall identify the types of insurance, state the limits of liability for each type of coverage, name the Owner a Consultants as Certificate Holder, provide that the general aggregate limit applies per project, and provide that coverage is written on an occurrence basis. Both the certificates and the

endorsements must be received directly from either the Contractor's insurance agent or the insurance company. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, naming the Owner as an additional insured for claims made under the Contractor's completed operations, and otherwise meeting the above requirements, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

3.83 *Delete Section 11.1.4 and substitute the following:*

11.1.4 A failure by the Owner either (i) to demand a certificate of insurance or written endorsement required by Section 11.1, or (ii) to reject a certificate or endorsement on the grounds that it fails to comply with Section 11.1 shall not be considered a waiver of Contractor's obligations to obtain the required insurance.

3.84 *In Section 11.3.1, delete the first sentence and substitute the following:*

Unless otherwise provided in the Contract Documents, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis.

3.85 *Delete the language of Section 11.3.1.2 and substitute the word "Reserved."*

3.86 *Delete the language of Section 11.3.1.3 and substitute the word "Reserved."*

3.87 *Delete Section 11.3.2 and substitute the following:*

11.3.2 BOILER AND MACHINERY INSURANCE

The Contractor shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall both be named insureds.

3.88 *Delete Section 11.3.3 and substitute the following:*

11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. To the extent any losses are covered and paid for by such insurance, the Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

3.89 *Delete Section 11.3.4 and substitute the following:*

11.3.4 If the Owner requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.

3.90 *Delete the language of Section 11.3.5 and substitute the word "Reserved."*

3.91 *Delete Section 11.3.6 and substitute the following:*

11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Owner.

3.92 Delete the first sentence of Section 11.3.7 and substitute the following:

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent the property insurance provided by the Contractor pursuant to this Section 11.3 covers and pays for the damage, except such rights as they have to proceeds of such insurance held by the Contractor as fiduciary.

3.93 *Delete the first sentence of Section 11.3.8 and substitute the following:*

A loss insured under the Contractor's property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10.

3.94 *Delete Section 11.3.9 and substitute the following:*

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

3.95 *Delete Section 11.3.10 and substitute the following:*

11.3.10 The Contractor as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Contractor's exercise of this power; if such objection is made, the dispute shall be resolved in the manner provided in the contract between the parties in dispute as the method of binding dispute resolution. The Contractor as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with a final order or determination issued by the appropriate authority having jurisdiction over the dispute..

3.96 *Delete Section 11.4.1 and substitute the following:*

11.4.1 Before commencing any services hereunder, the Contractor shall provide the Owner with Performance and Payment Bonds, each in an amount not less than the Contract Price set forth in Article 4 of the Agreement. The Surety shall have, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty". In addition, the Surety shall have a minimum "Best Financial Strength Category" of "Class V", and in no case less than five (5) times the contract amount. The Performance Bond shall be written on Form SE-355, "Performance Bond" and the Payment Bond shall written on Form SE-357, "Labor and Material Payment Bond", and both shall be made payable to the Owner.

3.97 *Delete Section 11.4.2 and substitute the following:*

11.4.2 The Performance and Labor and Material Payment Bonds shall:

.1 be issued by a surety company licensed to do business in South Carolina;
.2 be accompanied by a current power of attorney and certified by the attorney-in-fact who executes the bond on the behalf of the surety company; and
.3 remain in effect for a period not less than one (1) year following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer.

3.98 *Add the following Sections 11.4.3 and 11.4.4:*

11.4.3 Any bonds required by this Contract shall meet the requirements of the South Carolina Code of Laws and Regulations, as amended.

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

3.99 *Delete Section 12.1.1 and substitute the following:*

12.1.1 If a portion of the Work is covered contrary to the to requirements specifically expressed in the Contract Documents, including inspections of work-in-progress required by all authorities having jurisdiction over the Project, it must, upon demand of the Architect or authority having jurisdiction, be uncovered for observation and be replaced at the Contractor's expense without change in the Contract Time.

3.100 *In Section 12.2.2.1, delete the words "and to make a claim for breach of warranty" at the end of the third sentence.*

3.101 *In Section 12.2.2.3, add the following to the end of the sentence:*

unless otherwise provided in the Contract Documents.

3.102 *Insert the following at the end of Section 12.2.4:*

If, prior to the date of Substantial Completion, the Contractor, a Subcontractor, or anyone for whom either is responsible, uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

3.103 *Delete Section 13.1 and substitute the following:*

13.1 GOVERNING LAW
The Contract, any dispute, claim, or controversy relating to the Contract, and all the rights and obligations of the parties shall, in all respects, be interpreted, construed, enforced and governed by and under the laws of the State of South Carolina, except its choice of law rules.

3.104 *Delete Section 13.2, including its Sub-Sections 13.2.1 and 13.2.2, and substitute the following:*

13.2 SUCCESSORS AND ASSIGNS
The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole, or in part, without written consent of the other and then only in accordance with and as permitted by Regulation 19-445.2180 of the South Carolina Code of Regulations, as amended. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

3.105 *Delete Section 13.3 and substitute the following:*

13.3 WRITTEN NOTICE
Unless otherwise permitted herein, all notices contemplated by the Contract Documents shall be in writing and shall be deemed given:

- **.1** upon actual delivery, if delivery is by hand;
- **.2** upon receipt by the transmitting party of confirmation or reply, if delivery is by electronic mail, facsimile, telex or telegram;
- **.3** upon receipt, if delivery is by the United States mail.

Notice to Contractor shall be to the address provided in Section 8.3.2 of the Agreement. Notice to Owner shall be to the address provided in Section 8.2.2 of the Agreement. Either party may designate a different address for notice by giving notice in accordance with this paragraph.

3.106 *In Section 13.4.1, insert the following at the beginning of the sentence:*

Unless expressly provided otherwise,

3.107 *Add the following Section 13.4.3:*

13.4.3 Notwithstanding Section 9.10.4, the rights and obligations which, by their nature, would continue beyond the termination, cancellation, rejection, or expiration of this contract shall survive such termination, cancellation, rejection, or expiration, including, but not limited to, the rights and obligations created by the following clauses:

1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service;
3.5 Warranty
3.17 Royalties, Patents and Copyrights
3.18 Indemnification
7.6 Cost or Pricing Data
11.1 Contractor's Liability Insurance
11.4 Performance and Payment Bond
15.1.6 Claims for Listed Damages
15.1.7 Waiver of Claims Against the Architect
15.6 Dispute Resolution
15.4 Service of Process

3.108 *Delete Section 13.6 and substitute the following:*

13.6 INTEREST
Payments due to the Contractor and unpaid under the Contract Documents shall bear interest only if and to the extent allowed by Title 29, Chapter 6, Article 1 of the South Carolina Code of Laws. Amounts due to the Owner shall bear interest at the rate of one percent a month or a pro rata fraction thereof on the unpaid balance as may be due.

3.109 *Delete the language of Section 13.7 and substitute the word "Reserved."*

3.110 *Add the following Sections 13.8 through 13.16:*

13.8 PROCUREMENT OF MATERIALS BY OWNER
The Contractor accepts assignment of all purchase orders and other agreements for procurement of materials and equipment by the Owner that are identified as part of the Contract Documents. The Contractor shall, upon delivery, be responsible for the storage, protection, proper installation, and preservation of such Owner purchased items, if any, as if the Contractor were the original purchaser. The Contract Sum includes, without limitation, all costs and expenses in connection with delivery, storage, insurance, installation, and testing of items covered in any assigned purchase orders or agreements. Unless the Contract Documents specifically provide otherwise, all Contractor warranty of workmanship and correction of the Work obligations under the Contract Documents shall apply to the Contractor's installation of and modifications to any Owner purchased items,.

13.9 INTERPRETATION OF BUILDING CODES
As required by Title 10, Chapter 1, Section 180 of the South Caroline Code of Laws, as amended, OSE shall determine the enforcement and interpretation of all building codes and referenced standards on state buildings. The Contractor shall refer any questions, comments, or directives from local officials to the Owner and OSE for resolution.

13.10 MINORITY BUSINESS ENTERPRISES
Contractor shall notify Owner of each Minority Business Enterprise (MBE) providing labor, materials, equipment, or supplies to the Project under a contract with the Contractor. Contractor's notification shall be via the first monthly status report submitted to the Owner after execution of the contract with the MBE. For each such MBE, the Contractor shall provide the MBE's name, address, and telephone number, the nature of the work to be performed or materials or equipment to be supplied by the MBE, whether the MBE is certified by the South Carolina Office of Small and Minority Business Assistance, and the value of the contract.

13.11 SEVERABILITY
If any provision or any part of a provision of the Contract Documents shall be finally determined to be superseded, invalid, illegal, or otherwise unenforceable pursuant to any applicable Legal Requirements, such determination shall not impair or otherwise affect the validity, legality, or enforceability of the remaining provision or parts of the provision of the Contract Documents, which shall remain in full force and effect as if the unenforceable provision or part were deleted.

13.12 ILLEGAL IMMIGRATION
Contractor certifies and agrees that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws and agrees to provide to the State upon request any documentation required to establish either: (a) that Title 8, Chapter 14 is inapplicable both to Contractor and its subcontractors or sub-subcontractors; or (b) that Contractor and its subcontractors or sub-subcontractors are in compliance with Title 8, Chapter 14. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony, and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." Contractor agrees to include in any contracts with its subcontractors language requiring its subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14. (An overview is available at www.procurement.sc.gov)

13.13 SETOFF
The Owner shall have all of its common law, equitable, and statutory rights of set-off.

13.14 DRUG-FREE WORKPLACE
The Contractor certifies to the Owner that Contractor will provide a Drug-Free Workplace, as required by Title 44, Chapter 107 of the South Carolina Code of Laws, as amended.

13.15 FALSE CLAIMS
According to the S.C. Code of Laws § 16-13-240, "a person who by false pretense or representation obtains the signature of a person to a written instrument or obtains from another person any chattel, money, valuable security, or other property, real or personal, with intent to cheat and defraud a person of that property is guilty" of a crime.

13.16 NON-INDEMNIFICATION:
Any term or condition is void to the extent it requires the State to indemnify anyone. It is unlawful for a person charged with disbursements of state funds appropriated by the General Assembly to exceed the amounts and purposes stated in the appropriations. (§ 11-9-20) It is unlawful for an authorized public officer to enter into a contract for a purpose in which the sum is in excess of the amount appropriated for that purpose. It is unlawful for an authorized public officer to divert or appropriate the funds arising from any tax levied and collected for any one fiscal year to the payment of an indebtedness contracted or incurred for a previous year. (§ 11-1-40)

3.111 *Delete Section 14.1.1 and substitute the following:*

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 45 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires substantially all Work to be stopped; or

.2 An act of government, such as a declaration of national emergency that requires substantially all Work to be stopped.

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents and the Contractor has stopped work in accordance with Section 9.7

3.112 *Insert the following at the end of Section 14.1.3:*

Any adjustment to the Contract Sum pursuant to this Section shall be made in accordance with the requirements of Article 7.

3.113 *In Section 14.1.4, replace the word "repeatedly" with the word "persistently."*

3.114 *Delete Section 14.2.1 and substitute the following:*

14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials, or otherwise fails to prosecute the Work, or any separable part of the Work, with the diligence, resources and skill that will ensure its completion within the time specified in the Contract Documents, including any authorized adjustments;

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

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

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

3.115 *In Section 14.2.2, delete the parenthetical statement ", upon certification by the Initial Decision Maker that sufficient cause exists to justify such action," immediately following the word "Owner" in the first line.*

3.116 *In Section 14.2.4, replace the words "Initial Decision Maker" with the word "Architect"*

3.117 *Add the following Section 14.2.5:*

14.2.5 If, after termination for cause, it is determined that the Owner lacked justification to terminate under Section 14.2.1, or that the Contractor's default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Owner under Section 14.4.

3.118 *Delete the second sentence of Section 14.3.2 and substitute the following:*

Any adjustment to the Contract Sum made pursuant to this section shall be made in accordance with the requirements of Article 7.3.3.

3.119 *Delete Section 14.4.1 and substitute the following:*

14.4.1 The Owner may, at any time, terminate the Contract, in whole or in part for the Owner's convenience and without cause. The Owner shall give written notice of the termination to the Contractor specifying the part of the Contract terminated and when termination becomes effective.

3.120 *Delete Section 14.4.2 and substitute the following:*

14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders; and

.4 complete the performance of the Work not terminated, if any.

3.121 *Delete Section 14.4.3 and substitute the following:*

14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, costs incurred by reason of such termination, and any other adjustments otherwise allowed by the Contract. Any adjustment to the Contract Sum made pursuant to this Section 14.4 shall be made in accordance with the requirements of Article 7.3.3.

3.122 *Add the following Sections 14.4.4, 14.4.5, and 14.5:*

14.4.4 Contractor's failure to include an appropriate termination for convenience clause in any subcontract shall not (i) affect the Owner's right to require the termination of a subcontract, or (ii) increase the obligation of the Owner beyond what it would have been if the subcontract had contained an appropriate clause.

14.4.5 Upon written consent of the Contractor, the Owner may reinstate the terminated portion of this Contract in whole or in part by amending the notice of termination if it has been determined that:

.1 the termination was due to withdrawal of funding by the General Assembly, Governor, or Budget and Control Board or the need to divert project funds to respond to an emergency as defined by Regulation 19-445.2110(B) of the South Carolina Code of Regulations, as amended;

.2 funding for the reinstated portion of the work has been restored;

.3 circumstances clearly indicate a requirement for the terminated work; and

.4 reinstatement of the terminated work is advantageous to the Owner.

14.5 CANCELLATION AFTER AWARD BUT PRIOR TO PERFORMANCE
Pursuant to Title 11, Chapter 35 and Regulation 19-445.2085 of the South Carolina Code of Laws and Regulations, as amended, this contract may be canceled after award but prior to performance.

3.123 *Insert the following sentence after the second sentence of Section 15.1.1:*

A voucher, invoice, payment application or other routine request for payment that is not in dispute when submitted is not a Claim under this definition.

3.124 *Delete Section 15.1.2 and substitute the following:*

15.1.2 NOTICE OF CLAIMS
Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Architect. Such notice shall include sufficient information to advise the Architect and other party of the circumstances giving rise to the claim, the specific contractual adjustment or relief requested and the basis of such request. Claims by either party arising prior to the date final payment is due must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later except as stated for adverse weather days in Section 15.1.5.2. By failing to give written notice of a Claim within the time required by this Section, a party expressly waives its claim.

3.125 *Delete Section 15.1.3 and substitute the following:*

15.1.3 CONTINUING CONTRACT PERFORMANCE
Pending final resolution of a Claim, including any administrative review allowed under Section 15.6, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will issue Certificates for Payment in accordance with the initial decisions and determinations of the Architect.

3.126 *Insert the following at the end of Section 15.1.5.1:*

Claims for an increase in the Contract Time shall be based on one additional calendar day for each full calendar day that the Contractor is prevented from working.

3.127 *Insert the following Sub-Sections at the end of Section 15.1.5.2:*

.1 Claims for adverse weather shall be based on actual weather conditions at the job site or other place of performance of the Work, as documented in the Contractor's job site log.

.2 For the purpose of this Contract, a total of five (5) calendar days per calendar month (non-cumulative) shall be anticipated as "adverse weather" at the job site, and such time will not be considered justification for an extension of time. If, in any month, adverse weather develops beyond the five (5) days, the Contractor shall be allowed to claim additional days to compensate for the excess weather delays only to the extent of the impact on the approved construction schedule. The remedy for this condition is for an extension of time only and is exclusive of all other rights and remedies available under the Contract Documents or imposed or available by law.

.3 The Contractor shall submit monthly with their pay application all claims for adverse weather conditions that occurred during the previous month. The Architect shall review each monthly submittal in accordance with Section 15.5 and inform the Contractor and the Owner promptly of its evaluation. Approved days shall be included in the next Change Order issued by the Architect. Adverse weather conditions not claimed within the time limits of this Subparagraph shall be considered to be waived by the Contractor. Claims will not be allowed for adverse weather days that occur after the scheduled (original or adjusted) date of Substantial Completion.

3.128 *Delete Section 15.1.6 and substitute the following:*

15.1.6 CLAIMS FOR LISTED DAMAGES
Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor and Owner waive Claims against each other for listed damages arising out of or relating to this Contract.

15.1.6.1 For the Owner, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) costs suffered by a third party unable to commence work, (vi) attorney's fees, (vii) any interest, except to the extent allowed by Section 13.6 (Interest), (viii) lost revenue and profit for lost use of the property, (ix) costs resulting from lost productivity or efficiency.

15.1.6.2 For the Contractor, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest, except to the extent allowed by Section 13.6 (Interest); (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. Without limitation, this mutual waiver is applicable to all damages due to either party’s termination in accordance with Article 14.

15.1.6.3 Nothing contained in this Section shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

3.129 *Add the following Section 15.1.7:*

15.1.7 WAIVER OF CLAIMS AGAINST THE ARCHITECT
Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor waives all claims against the Architect and any other design professionals who provide design and/or project management services to the Owner, either directly or as independent contractors or subcontractors to the Architect, for listed damages arising out of or relating to this

Contract. The listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest; (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

3.130 ***Delete the language of Sections 15.2, 15.3, and 15.4, including all Sub-Sections, and substitute the word "Reserved" for the deleted language of each Section and Sub-Section.***

3.131 *Add the following Sections 15.5 and 15.6 with their sub-sections:*

15.5 CLAIM AND DISPUTES - DUTY OF COOPERATION, NOTICE, AND ARCHITECTS INITIAL DECISION

15.5.1 Contractor and Owner are fully committed to working with each other throughout the Project to avoid or minimize claims. To further this goal, Contractor and Owner agree to communicate regularly with each other and the Architect at all times notifying one another as soon as reasonably possible of any issue that if not addressed may cause loss, delay, and/or disruption of the Work. If claims do arise, Contractor and Owner each commit to resolving such claims in an amicable, professional, and expeditious manner to avoid unnecessary losses, delays, and disruptions to the Work.

15.5.2 Claims shall first be referred to the Architect for initial decision. An initial decision shall be required as a condition precedent to resolution pursuant to Section 15.6 of any Claim arising prior to the date of final payment, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered, or after all the Architect's requests for additional supporting data have been answered, whichever is later. The Architect will not address claims between the Contractor and persons or entities other than the Owner.

15.5.3 The Architect will review Claims and within ten days of the receipt of a Claim (1) request additional supporting data from the claimant or a response with supporting data from the other party or (2) render an initial decision in accordance with Section 15.5.5.

15.5.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Architect when the response or supporting data will be furnished or (3) advise the Architect that all supporting data has already been provided. Upon receipt of the response or supporting data, the Architect will render an initial decision in accordance with Section 15.5.5.

15.5.5 The Architect will render an initial decision in writing; (1) stating the reasons therefor; and (2) notifying the parties of any change in the Contract Sum or Contract Time or both. The Architect will deliver the initial decision to the parties within two weeks of receipt of any response or supporting data requested pursuant to Section 16.4, or within such longer period as may be mutually agreeable to the parties. If the parties accept the initial decision, the Architect shall prepare a Change Order with appropriate supporting documentation for the review and approval of the parties and the Office of State Engineer. If either the Contractor, Owner, or both, disagree with the initial decision, the Contractor and Owner shall proceed with dispute resolution in accordance with the provisions of Section 15.6.

15.5.6 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

15.6 DISPUTE RESOLUTION

15.6.1 If a claim is not resolved pursuant to Section 15.5 to the satisfaction of either party, both parties shall attempt to resolve the dispute at the field level through discussions between Contractor's Representative and Owner's Representative. If a dispute cannot be resolved through Contractor's Representative and Owner's Representative, then the Contractor's Senior Representative and the Owner's Senior Representative, upon the request of either party, shall meet as soon as conveniently possible, but in no case later than twenty-one days after such a request is made, to attempt to resolve such dispute. Prior to any meetings between the Senior

Representatives, the parties will exchange relevant information that will assist the parties in resolving their dispute. The meetings required by this Section are a condition precedent to resolution pursuant to Section 15.6.2.

15.6.2 If after meeting in accordance with the provisions of Section 15.6.1, the Senior Representatives determine that the dispute cannot be resolved on terms satisfactory to both the Contractor and the Owner, then either party may submit the dispute by written request to South Carolina's Chief Procurement Officer for Construction (CPOC). Except as otherwise provided in Article 15, all claims, claims, or controversies relating to the Contract shall be resolved exclusively by the appropriate Chief Procurement Officer in accordance with Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws, or in the absence of jurisdiction, only in the Court of Common Pleas for, or in the absence of jurisdiction a federal court located in, Richland County, State of South Carolina. Contractor agrees that any act by the State regarding the Contract is not a waiver of either the State's sovereign immunity or the State's immunity under the Eleventh Amendment of the United State's Constitution.

15.6.3 If any party seeks resolution to a dispute pursuant to Section 15.6.2, the parties shall participate in non-binding mediation to resolve the claim. If the claim is governed by Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws as amended and the amount in controversy is $100,000.00 or less, the CPOC shall appoint a mediator, otherwise, the mediation shall be conducted by an impartial mediator selected by mutual agreement of the parties, or if the parties cannot so agree, a mediator designated by the American Arbitration Association ("AAA") pursuant to its Construction Industry Mediation Rules. The mediation will be governed by and conducted pursuant to a mediation agreement negotiated by the parties or, if the parties cannot so agree, by procedures established by the mediator.

15.6.4 Without relieving any party from the other requirements of Sections 15.5 and 15.6, either party may initiate proceedings in the appropriate forum prior to initiating or completing the procedures required by Sections 15.5 and 15.6 if such action is necessary to preserve a claim by avoiding the application of any applicable statutory period of limitation or repose.

15.6.5 SERVICE OF PROCESS
Contractor consents that any papers, notices, or process necessary or proper for the initiation or continuation of any claims, claims, or controversies relating to the Contract; for any court action in connection therewith; or for the entry of judgment on any award made, may be served on Contractor by certified mail (return receipt requested) addressed to Contractor at the address provided for the Contractor's Senior Representative or by personal service or by any other manner that is permitted by law, in or outside South Carolina. Notice by certified mail is deemed duly given upon deposit in the United States mail.

3.132 *Add the following Article 16:*

ARTICLE 16 PROJECT-SPECIFIC REQUIREMENTS AND INFORMATION
16.1. Inspection Requirements: *(Indicate the inspection services required by the Contract)*

☒ Special Inspections are required and are not part of the Contract Sum. *(see section 01400)*
☒ Building Inspections are required and are not part of the Contract Sum. *(see section 01400)*
☐ Building Inspections are required and are part of the Contract Sum.

The inspections required for this Work are :
(Indicate which services are required and the provider)
☐ Civil: _____
☐ Structural: _____
☐ Mechanical: _____
☐ Plumbing: _____
☐ Electrical: _____
☐ Gas: _____
☐ Other *(list):* _____
Remarks: ALL INSPECTIONS ARE PROVIDE BY THE OWNER

16.1.1 Contractor shall schedule and request inspections in an orderly and efficient manner and shall notify the Owner whenever the Contractor schedules an inspection in accordance with the requirements of Section 16.1. Contractor shall be responsible for the cost of inspections scheduled and conducted without the Owner's knowledge and for any increase in the cost of inspections resulting from the inefficient scheduling of inspections.

16.2 List Cash Allowances, if any. *(Refer to attachments as needed* If *none, enter NONE)*
NONE

16.3. Requirements for Record Drawings, if any. *(Refer to attachments as needed.* If *none, enter NONE)*
REFER TO SECTION 01 7800 OF THE PROJECT MANUAL AND FOLLOW ANY OTHER SPECIFIC REQUIREMENTS STIPULATED ELSEWHERE IN THE CONTRACT DOCUMENTS.

16.4. Requirements for Shop Drawings and other submittals, if any, including number, procedure for submission, list of materials to be submitted, etc. *(Refer to attachments as needed. If none, enter NONE)*
REFER TO SECTION 01 3000 OF THE PROJECT MANUAL AND FOLLOW ANY OTHER SPECIFIC REQUIREMENTS STIPULTED ELSEWHERE IN THE CONTRACT DOCUMENTS.

16.5. Requirements for signage, on-site office or trailer, utilities, restrooms, etc., in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*
NONE

16.6. Requirements for Project Cleanup in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*
NONE

16.7. List all attachments that modify these General Conditions. *(If none, enter NONE)*
NONE

USC SUPPLEMENTAL GENERAL CONDITIONS

FOR CONSTRUCTION PROJECTS

1. Contractor's employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies and stairs. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the building to the work area. Providing safe, accessible, plywood pedestrian ways around construction may be required if a suitable alternative route is not available.

2. Fraternization between Contractor's employees and USC students, faculty or staff is strictly prohibited-zero tolerance!

3. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to $500 per violation.

4. Contractor's employees must adhere to the University's policy of maintaining a drug free and smoke-free/tobacco free workplace.

5. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.

6. A welding permit must be issued by the University Fire Marshall before any welding can begin inside a building. Project Manager will coordinate.

7. Contractor must notify the University immediately upon the discovery of suspect material such as those potentially containing asbestos or other such hazardous materials. These materials must not be disturbed until approved by the USC Project Manager.

8. At the beginning of the project, the USC Project Manager will establish the Contractor's lay-down area. This area will also be used for the Contractor's work vehicles. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site that are not regular or authorized parking lots. All other parking is the responsibility of the contractor to provide and coordinate. The lay down area will be clearly identified to the contractor by the PM, with a sketch or drawing provided to parking. In turn, the contractor will mark off this area with a sign containing the project name, PM name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the

PM. The area will be maintained in a neat and orderly fashion. Vehicles parked in the lay down area (or designated parking areas) will be clearly marked or display a CPC furnished placard for identification.

9. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.

10. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.

11. For all projects over $100,000, including IDC's, an SE-395, Contractor Performance Evaluation, will be completed by the USC Project Manager and reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed and a Construction Performance rating will be established.

12. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied at least 1 times per week. Construction waste must not be placed in University dumpsters. THE CONSTRUCTION SITE MUST BE THOROUGHLY CLEANED WITH ALL TRASH PICKED UP AND PROPERLY DISPOSED OF ON A DAILY BASIS AND THE SITE MUST BE LEFT IN A SAFE AND SANITARY CONDITION EACH DAY. THE UNIVERSITY WILL INSPECT JOB SITES REGULARLY AND WILL FINE ANY CONTRACTOR FOUND TO BE IN VIOLATION OF THIS REQUIREMENT AN AMOUNT OF UP TO $1,000 PER VIOLATION.

13. **Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until this is completed.**

14. The contractor will comply with all regulations set forth by OSHA and SCDHEC. Contractor must also adhere to USC's internal policies and procedures (available by request). As requested, the contractor will submit all Safety Programs and Certificates of Insurance to the University for review.

15. Tree protection fencing is required to protect existing trees and other landscape features to be preserved within a construction area. The limits of this fence will be evaluated for each situation with the consultant, USC Arborist and USC Project Manager. The tree protection fence shall be 5' high chain link fence unless otherwise approved by USC Project Manager. No entry or materials storage will be allowed inside the tree protection zone. A 4" layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone.

16. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following measures shall be taken: For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall

be placed over areas impacted. For single loads over 9,000 lbs., two layers of 3/4" plywood is required.

17. For projects requiring heavy loads to cross walks tree root zones or lawns. A construction entry road consisting of 10' X 16' oak logging mates on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.

18. Any damage to existing landscaping (including lawn areas) will be remediated before final payment is made.

19. Orange safety fence to be provided by the Contractor. (USC Arborist, Kevin Curtis may be contacted at 777-0033 or 315-0319)

Campus Vehicle Expectations.

1. All motorized vehicles on the University campus are expected to travel and park on roadways and /or in parking stalls.

2. All motorized vehicle traffic on USC walkways must first receive the Landscape Manager's authorization. Violators may be subject to fines and penalties.

3. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.

4. Contractors, vendors, and delivery personnel are required to obtain prior parking authorization before parking in a designated space. Violators may be subject to fines and/or penalties. See Item 9 below.

5. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held personally responsible for damages and restoration expense.

6. Vehicle drivers who park on landscape or drives must be able to produce written evidence on of need or emergency requiring parking on same.

7. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.

8. All drivers of equipment and vehicles will be respectful of University landscape, equipment, structures, fixtures and signage. All incidents of property damage will be reported to Parking Services or the Work Management Center.

9. Parking on campus is restricted to spaces designated by Parking Services at the beginning of the project. Once the Project Manager and Contractor agree on how many spaces are needed, the project manager will obtain a placard for each vehicle. This placard must be hung from the mirror of the vehicle, otherwise a ticket will be issued and these tickets cannot be “fixed”. Parking spaces are restricted to work vehicles only; no personal vehicles.

SE-355 2011 Edition
Performance Bond Rev.10-29-12

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____
Address: _____

Hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____
Address: _____

Hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: University of South Carolina
Address: 743 Greene Street
Columbia, South Carolina 29208

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____($_____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

State Project Name: Athletic Village Improvements - New Soccer Building
State Project Number: H27-6105-MJ-B
Brief Description of Awarded Work, as found on the SE-330, Bid Form: An approximately 11,200 square foot facility to accommodate soccer locker rooms and weight rooms. A one (1) storied with a mezzanine. Designed to receive LEED "Silver" certificate by the USGBC.

In accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: JHS ARCHITECTURE: INTEGRATED DESIGN
Address: 1812 Lincoln Street
Columbia, South Carolina 29201

Which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____day of _____, 2_____ BOND NUMBER _____
(shall be no earlier than Date of Contract)

CONTRACTOR	SURETY
By: _____ (Seal)	By: _____ (Seal)
Print Name: _____	Print Name: _____
Print Title: _____	Print Title: _____ (Attach Power of Attorney)
Witness: _____	Witness: _____

(Additional Signatures, if any, appear on attached page)

Performance Bond

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency for the full and faithful performance of the contract, which is incorporated herein by reference

2. If the Contractor performs the contract, the Surety and the Contractor have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.

3. The Surety's obligation under this Bond shall arise after:

3.1 The Agency has notified the Contractor and the Surety at the address described in paragraph 10 below, that the Agency is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If the Agency, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the Agency's right, if any, subsequently to declare a Contractor Default; or

3.2 The Agency has declared a Contractor Default and formally terminated the Contractor's right to complete the Contract.

4. The Surety shall, within 15 days after receipt of notice of the Agency's declaration of a Contractor Default, and at the Surety's sole expense, take one of the following actions:

4.1 Arrange for the Contractor, with consent of the Agency, to perform and complete the Contract; or

4.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Agency for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the Agency and the contractor selected with the Agency's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to the Agency the amount of damages as described in paragraph 7 in excess of the Balance of the Contract Sum incurred by the Agency resulting from the Contractor Default; or

4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and:

4.4.1 After investigation, determine the amount for which it may be liable to the Agency and, within 60 days of waiving its rights under this paragraph, tender payment thereof to the Agency; or

4.4.2 Deny liability in whole or in part and notify the Agency, citing the reasons therefore.

5. Provided Surety has proceeded under paragraphs 4.1, 4.2, or 4.3, the Agency shall pay the Balance of the Contract Sum to either:

5.1 Surety in accordance with the terms of the Contract; or

5.2 Another contractor selected pursuant to paragraph 4.3 to perform the Contract.

5.3 The balance of the Contract Sum due either the Surety or another contractor shall be reduced by the amount of damages as described in paragraph 7.

6. If the Surety does not proceed as provided in paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond 15 days after receipt of written notice from the Agency to the Surety demanding that the Surety perform its obligations under this Bond, and the Agency shall be entitled to enforce any remedy available to the Agency.

6.1 If the Surety proceeds as provided in paragraph 4.4, and the Agency refuses the payment tendered or the Surety has denied liability, in whole or in part, then without further notice the Agency shall be entitled to enforce any remedy available to the Agency.

6.2 Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the Dispute Resolution process defined in the Contract Documents and the laws of the State of South Carolina.

7. After the Agency has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Agency shall be those of the Contractor under the Contract, and the responsibilities of the Agency to the Surety shall those of the Agency under the Contract. To a limit of the amount of this Bond, but subject to commitment by the Agency of the Balance of the Contract Sum to mitigation of costs and damages on the Contract, the Surety is obligated to the Agency without duplication for:

7.1 The responsibilities of the Contractor for correction of defective Work and completion of the Contract; and

7.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under paragraph 4; and

7.3 Damages awarded pursuant to the Dispute Resolution Provisions of the Contract. Surety may join in any Dispute Resolution proceeding brought under the Contract and shall be bound by the results thereof; and

7.4 Liquidated Damages, or if no Liquidated Damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. The Surety shall not be liable to the Agency or others for obligations of the Contractor that are unrelated to the Contract, and the Balance of the Contract Sum shall not be reduced or set-off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Agency or its heirs, executors, administrators, or successors.

9. The Surety hereby waives notice of any change, including changes of time, to the contract or to related subcontracts, purchase orders and other obligations.

10. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the address shown on the signature page.

11. Definitions

11.1 Balance of the Contract Sum: The total amount payable by the Agency to the Contractor under the Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts to be received by the Agency in settlement of insurance or other Claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Contract.

11.2 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform the Contract or otherwise to comply with the terms of the Contract.

SE-357 2011 Edition
Labor and Material Payment Bond Rev.10-29-12

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____
Address: _____

Hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____
Address: _____

Hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: University of South Carolina
Address: 743 Greene Street
Columbia, South Carolina 29208

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____($_____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

State Project Name: Athletic Village Improvements - New Soccer Building
State Project Number: H27-6105-MJ-B
Brief Description of Awarded Work, as found on the SE-330, Bid Form: An approximately 11,200 square foot facility to accommodate soccer locker rooms and weight rooms. A one (1) storied with a mezzanine. Designed to receive LEED "Silver" certificate by the USGBC.

In accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: JHS ARCHITECTURE: INTEGRATED DESIGN
Address: 1812 Lincoln Street
Columbia, South Carolina 29201

Which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Labor and Material Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____day of _____, 2_____ BOND NUMBER _____
(shall be no earlier than Date of Contract)

CONTRACTOR	SURETY
By: _____ (Seal)	By: _____ (Seal)
Print Name: _____	Print Name: _____
Print Title: _____	Print Title: _____ (Attach Power of Attorney)
Witness: _____	Witness: _____

(Additional Signatures, if any, appear on attached page)

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency to pay for all labor, materials and equipment required for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to the Agency, this obligation shall be null and void if the Contractor:

2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants; and

2.2 Defends, indemnifies and holds harmless the Agency from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract.

3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

4. With respect to Claimants, and subject to the provisions of Title 29, Chapter 5 and the provisions of §11-35-3030(2)(c) of the SC Code of Laws, as amended, the Surety's obligation under this Bond shall arise as follows:

4.1 Every person who has furnished labor, material or rental equipment to the Contractor or its subcontractors for the work specified in the Contract, and who has not been paid in full therefore before the expiration of a period of ninety (90) days after the date on which the last of the labor was done or performed by him or material or rental equipment was furnished or supplied by him for which such claim is made, shall have the right to sue on the payment bond for the amount, or the balance thereof, unpaid at the time of institution of such suit and to prosecute such action for the sum or sums justly due him.

4.2 A remote claimant shall have a right of action on the payment bond upon giving written notice by certified or registered mail to the Contractor within ninety (90) days from the date on which such person did or performed the last of the labor or furnished or supplied the last of the material or rental equipment upon which such claim is made.

4.3 Every suit instituted upon a payment bond shall be brought in a court of competent jurisdiction for the county or circuit in which the construction contract was to be performed, but no such suit shall be commenced after the expiration of o ne year after the day on which the last of the labor was performed or material or rental equipment was supplied by the person bringing suit.

5. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

5.1 Send an answer to the Claimant, with a copy to the Agency, within sixty (60) days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

5.2 Pay or arrange for payment of any undisputed amounts.

5.3 The Surety's failure to discharge its obligations under this paragraph 5 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a claim. However, if the Surety fails to discharge its obligations under this paragraph 5, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.

6. Amounts owed by the Agency to the Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By the Contractor furnishing and the Agency accepting this Bond, they agree that all funds earned by the contractor in the performance of the Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Agency's prior right to use the funds for the completion of the Work.

7. The Surety shall not be liable to the Agency, Claimants or others for obligations of the Contractor that are unrelated to the Contract. The Agency shall not be liable for payment of any costs or expenses of any claimant under this bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

8. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.

9. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the Agency or the contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

10. By the Contractor furnishing and the Agency accepting this Bond, they agree that this Bond has been furnished to comply with the statutory requirements of the South Carolina Code of Laws, as amended, and further, that any provision in this Bond conflicting with said statutory requirements shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

11. Upon request of any person or entity appearing to be a potential beneficiary of this bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

12. Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the laws of the State of South Carolina.

13. **DEFINITIONS**

13.1 Claimant: An individual or entity having a direct contract with the Contractor or with a Subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of the Contractor and the Contractor's Subcontractors, and all other items for which a mechanic's lien might otherwise be asserted.

13.2 Remote Claimant: A person having a direct contractual relationship with a subcontractor of the Contractor or subcontractor, but no contractual relationship expressed or implied with the Contractor.

13.3 Contract: The agreement between the Agency and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

SE-380 **CHANGE ORDER NO.:**_____

CHANGE ORDER TO CONSTRUCTION CONTRACT

AGENCY: University of South Carolina

PROJECT NAME: Athletic Village Improvements - New Soccer Building

PROJECT NUMBER: H27-6105-MJ-B

CONTRACTOR: _____ **CONTRACT DATE:** _____

This Contract is changed as follows: *(Insert description of change in space provided below)*

ADJUSTMENTS IN THE CONTRACT SUM:

1.	**Original Contract Sum:**		$
2.	**Change in Contract Sum by previously approved Change Orders:**	$	
3.	**Contract Sum prior to this Change Order**		$ 0.00
4.	**Amount of this Change Order:**	$	
5.	**New Contract Sum, including this Change Order:**		$ 0.00

ADJUSTMENTS IN THE CONTRACT TIME:

1.	**Original Substantial Completion Date:**		
2.	**Sum of previously approved increases and decreases in Days:**		Days
3.	**Change in Days for this Change Order**		Days
4.	**New Substantial Completion Date:**		

CONTRACTOR ACCEPTANCE:

BY:_____ **Date:**_____
(Signature of Representative)

Print Name:_____

ARCHITECT RECOMMENDATION FOR ACCEPTANCE:

BY:_____ **Date:**_____
(Signature of Representative)

Print Name:_____

AGENCY ACCEPTANCE AND CERTIFICATION:

BY:_____ **Date:**_____
(Signature of Representative)

Print Name:_____

☐ Change is within Agency Construction Procurement Certification of: $_____

☐ Change is not within Agency Construction Procurement Certification of: $_____

Office of the State Engineer Authorization for change exceeding Agency Construction Procurement Certification:

AUTHORIZED BY:_____ **DATE:** _____
(OSE Project Manager)

SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Athletic Village Improvements - New Soccer Building Construction State Project Number H27-6105-MJ-B.

B. University of South Carolina's Name: The University of South Carolina.

C. Architect's Name: JHS Architecture: Integrated Design.

D. The Project consists of the construction of an approximately 11,200 square foot facility to accomodate soccer locker rooms and weight rooms adjacent to the Athletics Village and Eugene E. Stone lll Stadium at the corner of Heyward and Marion Streets. The building is a one (1) storied with a mezzanine.The building is intended to be designed and constructed in a manner required to receive LEED "Silver" Certification by the USGBC.

E.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on LUMP SUM BID as described in Standard Form of Agreement between Owner and Contractor (AIA Document A101-2007 Edition) and 00501-OSE Standard Modifications to AIA A101-2007..

1.03 WORK BY OWNER

A. The University of South Carolina will award a contract for supply and installation of the following:
   1. Graphics and Interior Signage, not covered elsewhere in the specifications.
   2. Telephone and Data equipment and patch cords. Data and voice wiring, including terminations, are provided by the General Contractor as indicated on the electrical plans and specifications.
   3. Exhibits, furnishings, furniture and equipment not requiring hard wiring, gas or plumbing connections.
   4. Owner's Testing Laboratory Services and Building/Special Inspections.
   5. Items noted as "NIC" (Not in Contract) will be supplied and installed by the University of South Carolina before Substantial Completion.
   6. All tap fees and meters

B. University of South Carolina will supply the following for installation by Contractor:
   1. As indicated on the drawings and below, the equipment listed shall be furnished by the University and to be installed by the General Contractor.
      a. Five foot round therapy tubs.
      b. Soap Dispensers.
      c. Toilet Tissue Dispensers.
      d. Flat Screen Televisions (wall mounted)

1.04 OWNER OCCUPANCY

A. University of South Carolina intends to occupy the project upon Substantial Completion.

B. Cooperate with University of South Carolina to minimize conflict and to facilitate The University of South Carolina's operations.

C. Prior to Substantial Completion, the furniture and small equipment installer may install their products if site conditions allow and the Contractor is not hampered by these activities.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Provide access to and from site as required by law and by the University of South Carolina:
   1. Do not obstruct roadways, sidewalks, or other public ways without permit.

2. Refer to Civil Drawings for Designated Access Path to Site.

C. Utility Outages and Shutdown:
1. Prevent accidental disruption of utility services to other facilities.

1.06 WORK SEQUENCE

A. Coordinate construction schedule and operations with the University of South Carolina.

1.07 CONTRACTOR'S RESPONSIBILITIES TO INCLUDE BUT NOT NECESSARILY LIMITED TO ARE:

A. Designate delivery date for each product in the Construction Progress Schedule allowing sufficient time for preparation of submittals and the Architect's review.

B. Review shop drawings, product data, and samples. Submit to Architect / Engineer with notification of any discrepancies or problems anticipated in the use of the product.

C. Receive and unload products at the Site in accordance with manufacturer's recommendations.

D. Promptly inspect products, record shortages, damaged or defective items.

E. Unload and handle products at the Site, including uncrating and storage.

F. Protect roof products from exposure to elements and from damage in accordance with manufacturer's recommendations.

G. Repair or replace items damaged by Contractor.

H. Pay all required sales, consumer and use taxes.

I. Secure and pay for, as necessary for execution of the Work and as applicable, all permits, fees and licenses

J. Give all notices required by the Contract Documents or by governing regulations.

K. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which pertain to proper performance of the Work, and promptly submit written notice to the Architect of any observed variance of the Contract Documents from legal requirements.

L. Enforce proper discipline and good order among employees at all times. Contractor's employees shall not in any manner interfere with or cause any form of nuisance to the Staff.

M. Refer to specification sections pertaining to roof systems for addition requirements.

1.08 TESTING AND SPECIAL INSPECTIONS

A. All testing shall be provided by the Owner. The Owner will select a pre-qualified independent testing agency to conduct construction testing and special inspections.

B. The General Contractor shall coordinate with the Owner's testing agency and assist with scheduling field testing in order to conduct the Work expeditiously. Representatives of the testing agency shall be allowed access to the site at all times.

C. The Owner will pay for initial testing. When initial testing indicates non-compliance with the Contract Documents, subsequent re-testing occassioned by non-compliance shall be performed by the same testing agency. The Owner shall retain the right to deduct the cost of subsequent re-testing from the Contract Sum at the Owner's discretion.

1.09 COORDINATION

A. The Contractor is advised that the Work required by this Project is to take place adjacent to other University facilities. As such, it is of extreme importance that the Contractor carry out his activities in as non-disruptive of a manner as possible with ultimate attention given to courtesy and professionalism. Activities must be coordinated well in advance with the University of South Carolina.

1.10 PARKING

A. The Contractor shall coordinate the required parking spaces for his employees, sub-contractors, etc.with USC.

1.11 SAFETY

A. It is the policy of JHS Architecture: Integrated Design, Inc. to require that the means and methods of construction to be determined by the Contractor. It is expected that the Contractor will conduct his activities with complete and uncompromised care with regard to the safety of his workers and the employees and students of the University of South Carolina.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to JHS Architecture: Integrated Design for approval.

B. Forms filled out by hand will not be accepted.

C. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

1. Items shall include the following as a minimum:
    a. Liability Insurance.
    b. Builders Risk Insurance.
    c. Payment and Performance Bond.
    d. General Conditions.
    e. Site Mobilization.
    f. Site Demolition.
    g. Grading/Backfilling.
    h. Concrete Work.
    i. Sanitary Sewer.
    j. Water System.
    k. Concrete Foundations.
    l. Concrete Slab on Grade.
    m. Masonry Block.
    n. Precast Architectural Concrete.
    o. Precast Roof Pavers and Accessories
    p. Brick Masonry Veneer.
    q. Structural Steel Frame and Decking.
    r. Steel Erection.
    s. Miscellaneous Steel.
    t. Rough Carpentry.
    u. MIllwork and Finish Carpentry.
    v. Membrane Roofing.
    w. Water Repellants.
    x. Aluminum Glazing Systems.
    y. Aluminum Panels
    a`. Passage Doors.
    aa. Door Hardware.
    ab. Drywall Construction.
    ac. Acoustical Ceilings.
    ad. Ceramic Tile

ae. Resilient Flooring and Base.
af. Carpet and Base.
ag. Painting.
ah. Toilet and Shower Partitions and Accessories.
ai. Fire Protection Systems.
aj. Plumbing Systems.
ak. HVAC Systems.
al. Electrical Systems.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization. and bonds and insurance.

F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to JHS Architecture: Integrated Design for approval.

C. Forms filled out by hand will not be accepted.

D. Present required information in typewritten form.

E. Form: AIA G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.

F. For each item, provide a column for listing each of the following:
1. Item Number.
2. Description of work.
3. Scheduled Values.
4. Previous Applications.
5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

G. Execute certification by signature of authorized officer.

H. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

J. Submit three copies of each Application for Payment.

K. Include the following with the application:
1. Transmittal letter as specified for Submittals in Section 01 3000.
2. Construction progress schedule, revised and current as specified in Section 01 3000.
3. Current construction photographs specified in Section 01 3000.
4. Partial release of liens from major Subcontractors and vendors.
5. Affidavits attesting to off-site stored products.

L. When JHS Architecture: Integrated Design requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.04 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, JHS Architecture: Integrated Design will issue instructions directly to Contractor.

B. JHS Architecture: Integrated Design will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instruction on AIA Form G710.

C. For other required changes, JHS Architecture: Integrated Design will issue a document signed by the University of South Carolina instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

D. For changes for which advance pricing is desired, Architectwill issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 15 days.

E. Contractor may propose a change by submitting a request for change to JHS Architecture: Integrated Design , describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by JHS Architecture: Integrated Design for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by JHS Architecture: Integrated Design .
   3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
   4. For change ordered by JHS Architecture: Integrated Design without a quotation from Contractor, the amount will be determined by JHS Architecture: Integrated Design based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of alternates.

B. Procedures for pricing alternates #1 includes all labor, materials and construction time shown on sheets L-1, L-2, and I-1; Alternate #2 includes all labor, materials and construction time shown on sheets S 1, S 2, S 3, & S4.

1.02 SCHEDULE OF ALTERNATES

A. ADD ALTERNATE NO. 1 - LANDSCAPING PLANS AS SHOWN ON SHEETS L-1, L-2, AND IRRIGATION PLAN SHOWN ON SHEET I-1.:

B. ADD ALTERNATE NO. 2 - HARDSCAPE LANDSCAPING INCLUDING BRICK COLUMNS AND ASSOCIATED FOOTINGS AND WROUGHT IRON FENCING AND GATES AS SHOWN ON SHEETS S1, S2, S3, AND S4.:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site mobilization meeting.

B. Construction progress schedule.

C. Coordination drawings.

D. Submittals for review, information, and project closeout.

E. Number of copies of submittals.

F. Submittal procedures.

1.02 PROJECT COORDINATION

A. Project Coordinator: Ann Derrick, University of South Carolina

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Progress schedules.
   8. Coordination drawings.
   9. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SITE MOBILIZATION MEETING

A. The University of South Carolina will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. University of South Carolina.
   3. JHS Architecture: Integrated Design
   4. Contractor's Superintendent.
   5. Major Subcontractors.

C. Agenda:
   1. Use of premises by the University of South Carolina and Contractor.

2. The University of South CarolinaUniversity of South Carolina's requirements and occupancy prior to completion.
3. Construction facilities and controls provided by University of South Carolina.
4. Temporary utilities provided by University of South Carolina.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, University of South Carolina, participants, and those affected by decisions made.

3.02 CONSTRUCTION PROGRESS SCHEDULE

A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major contractors have reviewed and accepted proposed schedule.

C. Within 10 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

3.03 COORDINATION DRAWINGS

3.04 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - CLOSEOUT SUBMITTALS.

3.05 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for University of South Carolina. No action will be taken.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

B. Submit for University of South Carolina's benefit during and after project completion.

3.07 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Architect.

B. Documents for Information: Submit two copies.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.08 SUBMITTAL PROCEDURES

A. Transmit each submittal with a copy of approved submittal form.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Schedule submittals to expedite the Project, and coordinate submission of related items.

F. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

G. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

H. Provide space for Contractor and Architect review stamps.

I. When revised for resubmission, identify all changes made since previous submission.

J. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction progress schedule.

1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect JHS Architecture: Integrated Design

G. Submit under transmittal letter form specified in Section 01 3000.

1.03 QUALITY ASSURANCE

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

1.04 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches or width required.

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from JHS Architecture: Integrated Design. Indicate decision dates for selection of finishes.

E. Indicate delivery dates for owner-furnished products.

F. Coordinate content with schedule of values specified in Section 01 2000.

G. Provide legend for symbols and abbreviations used.

3.02 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.03 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to the University of South Carolina and to the University of South Carolina's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

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

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, JHS Architecture: Integrated Design, the University of South Carolina, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 01 3553
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 SECURITY PROGRAM

A. Protect Work, existing premises and the University of South Carolina's operations from theft, vandalism, and unauthorized entry.

B. Initiate program in coordination with the University of South Carolina's existing security system at project mobilization.

C. Maintain program throughout construction period until the University of South Carolina's occupancy.

1.03 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

C. Maintain log of workers and visitors, make available to the University of South Carolina on request.

D. The University of South Carolina will control entrance of persons and vehicles related to the University of South Carolina's operations and to the construction site.

E. Coordinate access of the University of South Carolina's personnel to site in coordination with the University of South Carolina's security forces.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance submittals.

B. Mock-ups.

C. Control of installation.

D. Tolerances.

E. Manufacturers' field services.

1.02 SUBMITTALS

A. Design Data: Submit for JHS Architecture: Integrated Design's knowledge as contract administrator or for the University of South Carolina, for inforamtion for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents as requested.

B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to JHS Architecture: Integrated Design, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to JHS Architecture: Integrated Design.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the University of South Carolina's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

E. Manufacturer's Field Reports: Submit reports for JHS Architecture: Integrated Design's benefit as contract administrator or for the University of South Carolina.
   1. Submit report in duplicate within 30 days of observation to JHS Architecture: Integrated Design for information.
   2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

F. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for the University of South Carolina.

1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by JHS Architecture: Integrated Design or the University of South Carolina.

1.03 REFERENCES AND STANDARDS - SEE SECTION 01 4219

1.04 TESTING AND INSPECTION AGENCIES

A. The University of South Carolina will employ and pay for services of an independent testing agency to perform specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where mock-up has been accepted by JHS Architecture: Integrated Design and the University of South Carolina and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

E. Mock-up: Refer to the Drawings for mock-up design.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
   1. Observer subject to approval of JHS Architecture: Integrated Design .
   2. Observer subject to approval of the University of South Carolina.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of JHS Architecture: Integrated Design, it is not practical to remove and replace the Work, JHS Architecture: Integrated Design will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4219
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue specified in this section, except where a specific date is established by applicable code.

C. Obtain copies of standards when required by the Contract Documents.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by the Contract Documents by mention or inference otherwise in any reference document.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 REFER TO SPECIFIC SPECIFICATIONS SECTIONS FOR REFERENCE STANDARDS

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Field offices.

1.02 TEMPORARY UTILITIES - SEE SECTION 01 5100

A. Provide and pay for all electrical power, lighting, and ventilation required for construction purposes. Once the heating and cooling system is operational, the Contractor is allowed to use the chilled water and hot water/steam from the University of South Carolina infrastructure at the Universities expense.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Telephone Land Lines: One line, minimum; one handset per line.
   3. Internet Connections: Minimum of one; DSL modem or faster.
   4. Email: Account/address reserved for project use.
   5. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is not permitted.

C. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations .

B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. The site will be secured with fencing which is not in the scope of this Project. It is provided by University of South Carolina under separate contract.

1.07 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and University of South Carolina's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with the University of South Carolina's security program.

1.08 VEHICULAR ACCESS AND PARKING - SEE SECTION 01 5500

A. Provide and maintain access to fire hydrants, free of obstructions.

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

C. Designated existing on-site roads may be used for construction traffic.

D. Existing parking areas within the lay down areas may be used for construction parking.

1.09 WASTE REMOVAL

A. See Section 01 7419 - Waste Management, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

1.10 FIELD OFFICES - SEE SECTION 01 5213

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

C. Locate offices a minimum distance of 50 feet from new structure and locate within construction area designated on Sheet A0.2.

1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5100
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 TEMPORARY ELECTRICITY

A. Cost: By Contractor.

B. Provide power service required from utility source.
   1. Do not disrupt the University of South Carolina's need for continuous service.
   2. Exercise measures to conserve energy.

C. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

D. Provide main service disconnect and over-current protection at convenient location and meter.

E. Permanent convenience receptacles may be utilized during construction.

F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft .

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lighting and provide routine repairs.

D. Permanent building lighting may be utilized during construction.

1.04 TEMPORARY HEATING

A. Cost of Energy: By Contractor.

B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

D. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

E. Refer to Section 01 8113 - Sustainable Design Requirements for information regarding Construction Indoor-Air-Quality Management.

1.05 TEMPORARY COOLING

A. Cost of Energy: Provided by the University of South Carolina when associated with the chilled water supply and return loops.

B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

C. Maintain maximum ambient temperature of 78 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

D. The University of South Carolina's existing cooling plant may be used.
   1. Exercise measures to conserve energy

2. Enclose building prior to activating temporary cooling.

E. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

F. Refer to Section 01 8113 - Sustainable Design Requirements for information regarding Construction Indoor-Air-Quality Management.

1.06 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Contractor.

B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

C. Connect to existing water source.
1. Exercise measures to conserve water.

D. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Maintenance and removal.

1.02 USE OF EXISTING FACILITIES

A. Existing facilities shall not be used for field offices.

1.03 USE OF PERMANENT FACILITIES

A. When permanent facilities are enclosed with operable utilities, relocate offices into building, with written agreement of University of South Carolina, and remove temporary buildings.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.

B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.

C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.

D. Exterior Materials: Weather resistant, finished in one color.

E. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.

F. Lighting for Offices: 50 fc at desk top height, exterior lighting at entrance doors.

G. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONTRACTOR OFFICE AND FACILITIES

A. Size: For Contractor's needs and to provide space for project meetings.

B. Telephone: As specified in Section 01 5000.

C. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.

D. Other Furnishings: Contractor's option.

E. Equipment: Six adjustable band protective helmets for visitors, one 10 inch outdoor weather thermometer and _____.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

B. Employee Residential Occupancy: Not allowed on University of South Carolina's property.

3.03 MAINTENANCE AND CLEANING

A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 01 5500
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access roads.

B. Parking.

C. Existing pavements and parking areas.

D. Permanent pavements and parking facilities.

E. Construction parking controls.

F. Flag persons.

G. Haul routes.

H. Maintenance.

I. Removal, repair.

J. Mud from site vehicles.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

PART 3 EXECUTION

3.01 PREPARATION

A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.02 ACCESS ROADS

A. Use of designated existing on-site streets and driveways for construction traffic is permitted.

B. Tracked vehicles not allowed on paved areas.

C. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.

D. Provide and maintain access to fire hydrants free of obstructions.

3.03 PARKING

A. Use of designated existing parking facilities by construction personnel is permitted.

B. Do not allow heavy vehicles or construction equipment in parking areas.

C. Arrange for temporary parking areas to accommodate use of construction personnel off-site at Contractor's expense.

3.04 NEW PERMANENT PAVEMENTS

A. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.05 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations. Post the University of South Carolina furnished contractor identification sheets in window when parked.

B. Monitor parking of construction personnel's vehicles . Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.06 FLAG PERSONS

A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.07 HAUL ROUTES

A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.08 TRAFFIC SIGNS AND SIGNALS

A. Relocate as Work progresses, to maintain effective traffic control.

3.09 MAINTENANCE

A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, Products, mud, snow, and ice.

B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.10 REMOVAL, REPAIR

A. Repair existing facilities damaged by use, to original condition.

B. Remove equipment and devices when no longer required.

C. Repair damage caused by installation.

3.11 MUD FROM SITE VEHICLES

A. Provide means of removing mud from vehicle wheels before exiting site onto public roadways or University property outside the construction site boundries.

END OF SECTION

SECTION 01 5721
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality after completion of construction.

D. Testing air change effectiveness after completion of construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

C. Ventilation: HVAC system has been designed to achieve the minimum requirements for ventilation specified in ASHRAE 62.1 with air change effectiveness of 0.9 or greater.

1.03 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA IAQ Guidelines for Occupied Buildings Under Construction as a guide.
   1. Submit not less than 60 days before enclosure of building.
   2. Identify potential sources of odor and dust.
   3. Identify construction activities likely to produce odor or dust.
   4. Identify areas of project potentially affected, especially occupied areas.
   5. Evaluate potential problems by severity and describe methods of control.
   6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
   7. Describe cleaning and dust control procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

E. Air Contaminant Test Plan: Identify:
   1. Testing agency qualifications.
   2. Locations and scheduling of air sampling.
   3. Test procedures, in detail.
   4. Test instruments and apparatus.
   5. Sampling methods.

F. Air Contaminant Test Reports: Show:
   1. Location where each sample was taken, and time.
   2. Test values for each air sample; average the values of each set of 3.
   3. HVAC operating conditions.
   4. Certification of test equipment calibration.
   5. Other conditions or discrepancies that might have influenced results.

G. Ventilation Effectiveness Test Plan: Identify:
   1. Testing agency qualifications.
   2. Description of test spaces, including locations of air sampling.
   3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
   4. Test instruments and apparatus; identify tracer gas to be used.
   5. Sampling methods.

H. Ventilation Effectiveness Test Reports: Show:
   1. Include preliminary tests of instruments and apparatus and of test spaces.
   2. Calculation of ventilation effectiveness, E.
   3. Location where each sample was taken, and time.
   4. Test values for each air sample.
   5. HVAC operating conditions.
   6. Other information specified in ASHRAE 129.
   7. Other conditions or discrepancies that might have influenced results.

1.05 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See Section 01 8113.

B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. HVAC equipment and supply air ductwork may be used for ventilation during construction:
   1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
   2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
      a. MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

3. Do not use return air ductwork for ventilation.
4. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.

E. Do not store construction materials or waste in mechanical or electrical rooms.

F. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
1. Inspect duct intakes, return air grilles, and terminal units for dust.
2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
3. Clean tops of doors and frames.
4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
5. Clean return plenums of air handling units.
6. Remove intake filters last, after cleaning is complete.

G. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

H. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

3.02 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:
1. All construction is complete.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
4. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
5. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
1. Obtain the University of South Carolina's concurrence that construction is complete enough before beginning flush-out.
2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.
3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
   a. Begin ventilation at least three hours prior to daily occupancy.
   b. Continue ventilation during all occupied periods.
   c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.03 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before occupancy.

C. Do not start air contaminant testing until:

1. All construction is complete, including interior finishes.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
4. New HVAC filtration media have been installed.

D. Indoor Air Samples: Collect from spaces representative of occupied areas:
1. Collect samples while exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.
3. Collect samples from height from 36 inches to 72 inches above floor.
4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
6. When retesting the same building areas, take samples from at least the same locations as in first test.

E. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

F. Analyze air samples and submit report.

G. Air Contaminant Concentration Determination and Limits:
1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
2. Carbon Monoxide: Measure in ppm, in relation to outdoor air; not more than outside air.
3. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
4. Formaldehyde: Not more than 50 parts per billion.
5. Formaldehyde: Measure in micrograms per cubic meter, in relation to outside air; not more than 20 micrograms per cubic meter higher than outside air.
6. Total Volatile Organic Compounds (TVOC): Not more than 500 micrograms per cubic meter.
7. Total Volatile Organic Compounds (TVOC): Measure in micrograms per cubic meter, in relation to outside air; not more than 200 micrograms per cubic meter higher than outside air.
8. Particulates (PM10): Not more than 50 micrograms per cubic meter.
9. Total Particulates (PM): Measure in micrograms per cubic meter, in relation to outside air; not more than 20 micrograms per cubic meter higher than outside air.

H. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to the University of South Carolina, or conduct full building flush-out specified above.

3.04 VENTILATION EFFECTIVENESS TESTING

A. Perform ventilation effectiveness testing before occupancy.

B. Do not begin ventilation effectiveness testing until:
1. HVAC testing, adjusting, and balancing has been satisfactorily completed.
2. Building flush-out or air contaminant testing has been completed satisfactorily.
3. New HVAC filtration media have been installed.

C. Test each air handler zone in accordance with ASHRAE 129.
1. "Air Handler Zone" refers to each of the 6 air handlers (2 per floor) and not to each of the VAV zones throughout the building.

D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to the University of South Carolina.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Procedures for University of South Carolina-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.02 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. JHS Architecture: Integrated Design will consider requests for substitutions only within 15 days after date of Agreement.

C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to the University of South Carolina.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

G. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. JHS Architecture: Integrated Design will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

A. The University of South Carolina's Responsibilities:
   1. Arrange for and deliver University of South Carolina reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review University of South Carolina reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with the University of South Carolina.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of the University of South Carolina personnel.

H. Closeout procedures, except payment procedures.

I. General requirements for maintenance service.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of University of South Carolina or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Effect on work of University of South Carolina or separate Contractor.
      f. Written permission of affected separate Contractor.
      g. Date and time work will be executed.

1.03 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in Columbia, South Carolina and acceptable to JHS Architecture: Integrated Design. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.04 PROJECT CONDITIONS

A. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, and drains, to prevent water flow.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After the University of South Carolina occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of the University of South Carolina's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify JHS Architecture: Integrated Design four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to JHS Architecture: Integrated Design, the University of South Carolina, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify JHS Architecture: Integrated Design of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on Drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to JHS Architecture: Integrated Design the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to JHS Architecture: Integrated Design.

H. Utilize recognized engineering survey practices.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

L. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

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

3.06 CUTTING AND PATCHING

A. Execute cutting and patching including excavation and fill to complete the Work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

B. Whenever possible, execute the work by methods that avoid cutting or patching.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.09 SYSTEM STARTUP

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

B. Notify JHS Architecture: Integrated Design seven days prior to start-up of each item.

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

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

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

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

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

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.11 ADJUSTING

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

B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593.

3.12 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to JHS Architecture: Integrated Design.
   2. Provide copies to the University of South Carolina.

B. Accompany JHS Architecture: Integrated Design and University of South Carolina on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.

C. Notify JHS Architecture: Integrated Design when work is considered ready for Substantial Completion.

D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for JHS Architecture: Integrated Design's review.

E. The University of South Carolina will occupy all of the building as specified in Section 01 1000.

F. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to the University of South Carolina-occupied areas.

G. Notify JHS Architecture: Integrated Design when work is considered finally complete.

H. Complete items of work determined by JHS Architecture: Integrated Design's final inspection.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

D. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the University of South Carolina.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. The University of South Carolina requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. University of South Carolina may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. LEED Certification for this project is dependent on diversion of 50 percent, by weight, of potential landfill trash/waste by recycling and/or salvage per LEED NC MR2.1.

F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

G. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
   1. Submit to Architect for University of South Carolina's review and approval.
   2. If University of South Carolina wishes to implement any cost alternatives, the Contract Price will be adjusted as specified elsewhere.
   3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
   4. Describe as many alternatives to landfilling as possible:
      a. List each material proposed to be salvaged, reused, or recycled.
      b. List the proposed local market for each material.
      c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
   5. Provide alternatives to landfilling for at least the following materials:
      a. Aluminum and plastic beverage containers.
      b. Corrugated cardboard.
      c. Wood pallets.
      d. Clean dimensional wood.
      e. Land clearing debris, including brush, branches, logs, and stumps.
      f. Concrete.
      g. Bricks.
      h. Concrete masonry units.
      i. Asphalt paving.
      j. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
      k. Gypsum drywall and plaster.
      l. Plastic buckets.
      m. Carpet, carpet tile, and carpet remnants : DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
      n. Paint.
      o. Plastic sheeting.
      p. Rigid foam insulation.

C. Once University of South Carolina has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect.

D. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.

2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   a. List each material proposed to be salvaged, reused, or recycled.
4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

E. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to University of South Carolina.
3. Landfill Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
   c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Recycled Materials: Include the following information for each:
   a. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
   b. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   c. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   d. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
5. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, University of South Carolina, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
1. Pre-bid meeting.
2. Pre-construction meeting.

3. Regular job-site meetings.
4. Job safety meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
         1) Paper/Cardboard.
         2) Gypsum Wallboard.
         3) Mixed Waste.
         4) Rubble.
         5) Steel.
         6) Aluminum.
         7) Wood.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 SUBMITTALS

A. Project Record Documents: Submit documents to JHS Architecture: Integrated Design with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. JHS Architecture: Integrated Design will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by the University of South Carolina, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with JHS Architecture: Integrated Design comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with the University of South Carolina's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by the University of South Carolina.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for University of South Carolina's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of JHS Architecture: Integrated Design, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.

N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of JHS Architecture: Integrated Design and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with University of South Carolina's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of University of South Carolina personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Items specified in individual product Sections.
   7. Landscape irrigation.

C. Training of the University of South Carolina personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: The University of South Carolina will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.

2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

1.03 QUALITY ASSURANCE

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by University of South Carolina.

B. Demonstrations conducted during Functional Testing need not be repeated unless University of South Carolina personnel training is specified.

C. Demonstration may be combined with University of South Carolina personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Provide training in minimum two hour segments.

C. Training schedule will be subject to availability of the University of South Carolina's personnel to be trained; re-schedule training sessions as required by the University of South Carolina; once schedule has been approved by the University of South Carolina failure to conduct sessions according to schedule will be cause for the University of South Carolina to charge Contractor for personnel "show-up" time.

D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

E. Product- and System-Specific Training:

1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 01 8113
SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on LEED-NC, Version 2.2.

1.02 DEFINITIONS

A. LEED: Leadership in Energy & Environmental Design.

B. Rapidly Renewable Materials: Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

C. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

D. Recycled Content: The recycled content value of a material assembly shall be determined by weight.
   1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
   2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.03 SUBMITTALS

A. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
   1. Plumbing.
   2. Mechanical.
   3. Electrical.
   4. Specialty items such as elevators and equipment.

B. LEED Action Plans: Provide preliminary submittals within 60 days of date established for the Notice to Proceed indicating how the following requirements will be met:
   1. Credit MR 4.1 and Credit MR 4.2: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
   2. Credit MR 5.1 and Credit MR 5.2: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.

C. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans.

D. LEED Documentation Submittals:
   1. Credit MR 4.1 and Credit MR 4.2: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

2. Credit MR 5.1 and Credit MR 5.2: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. Credit MR 6: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
4. Credit EQ 3.1:
   a. Construction indoor-air-quality management plan.
   b. Product data for temporary filtration media.
   c. Product data for filtration media used during occupancy.
   d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
5. Credit EQ 3.2:
   a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
   b. Product data for filtration media used during flush-out and during occupancy.
6. Credit EQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.
7. Credit EQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.
8. Credit EQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

PART 2 - PRODUCTS

2.01 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4.1 and Credit MR 4.2: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials used for Project.
   1. Cost of post-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
   2. Cost of pre-consumer recycled content of an item shall be determined by dividing weight of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
   3. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.02 REGIONAL MATERIALS

A. Credit MR 5.1 and Credit MR 5.2: Provide a minimum of 20 percent of building materials (by cost) that are regional materials.

2.03 LOW-EMITTING MATERIALS

A. Credit EQ 4.1: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D:
   1. Wood Glues: 30 g/L.
   2. Metal to Metal Adhesives: 30 g/L.
   3. Adhesives for Porous Materials (Except Wood): 50 g/L.
   4. Subfloor Adhesives: 50 g/L.
   5. Plastic Foam Adhesives: 50 g/L.

6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesive: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesive: 100 g/L.
18. Structural Wood Member Adhesive: 140 g/L.
19. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
20. Top and Trim Adhesive: 250 g/L.
21. Plastic Cement Welding Compounds: 250 g/L.
22. ABS Welding Compounds: 325 g/L.
23. CPVC Welding Compounds: 490 g/L.
24. PVC Welding Compounds: 510 g/L.
25. Adhesive Primer for Plastic: 550 g/L.
26. Sheet Applied Rubber Lining Adhesive: 850 g/L.
27. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
28. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
29. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
30. Other Adhesives: 250 g/L.
31. Architectural Sealants: 250 g/L.
32. Nonmembrane Roof Sealants: 300 g/L.
33. Single-Ply Roof Membrane Sealants: 450 g/L.
34. Other Sealants: 420 g/L.
35. Sealant Primers for Nonporous Substrates: 250 g/L.
36. Sealant Primers for Porous Substrates: 775 g/L.
37. Modified Bituminous Sealant Primers: 500 g/L.
38. Other Sealant Primers: 750 g/L.

B. Credit EQ 4.2: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D:
   1. Flat Paints, Coatings, and Primers: VOC not more than 50 g/L.
   2. Nonflat Paints, Coatings, and Primers: VOC not more than 150 g/L.
   3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
   5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
   6. Floor Coatings: VOC not more than 100 g/L.
   7. Shellacs, Clear: VOC not more than 730 g/L.
   8. Shellacs, Pigmented: VOC not more than 550 g/L.
   9. Stains: VOC not more than 250 g/L.

C. Credit EQ 4.4: Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.01 REFRIGERANT REMOVAL

A. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23 Sections.

3.02 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Credit EQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
   1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Utilities," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
   2. Replace all air filters immediately prior to occupancy.

B. Credit EQ 3.2 - Comply with one of the following requirements:
   1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. (4 300 000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.
   2. Air-Quality Testing:
      a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED-NC: Reference Guide."
      b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
         1) Formaldehyde: 50 ppb.
         2) Particulates (PM10): 50 micrograms/cu. m.
         3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
         4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
         5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
      c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
      d. Air-sample testing shall be conducted as follows:
         1) All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
         2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
         3) Number of sampling locations will vary depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. (2300 sq. m) or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.

4) Air samples shall be collected between 3 and 6 feet (0.9 and 1.8 m) from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION

SECTION 01 9113
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to University of South Carolina are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the University of South Carolina's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2003 preferred.
   5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.
   6. LEED Submittals: Submit approved submittals in accordance with procedures specified in Section 01 3515.

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan and pump curves.
   5. Factory test reports.
   6. Warranty information, including details of University of South Carolina's responsibilities in regard to keeping warranties in force.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of University of South Carolina.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to University of South Carolina; such equipment, tools, and instruments are to become the property of University of South Carolina.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of University of South Carolina.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
   3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at his option.
   6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
   1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.
   2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
   3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
   4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
   1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
   2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to University of South Carolina.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to University of South Carolina; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
   3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
   4. Contractor shall bear the cost of University of South Carolina and Commissioning Authority personnel time witnessing re-testing.
   5. Contractor shall bear the cost of University of South Carolina and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
      b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
      c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
      d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by University of South Carolina beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
   1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
   2. Verify that sensors with shielded cable are grounded only at one end.
   3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
   4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
   1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
   3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
   1. Disconnect sensor.
   2. Connect a signal generator in place of sensor.
   3. Connect ammeter in series between transmitter and building automation system control panel.
   4. Using manufacturer’s resistance-temperature data, simulate minimum desired temperature.
   5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
   6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
   7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
   8. Reconnect sensor.
   9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
   11. If not, replace sensor and repeat.
   12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
   1. Watthour, Voltage, Amperage: 1 percent of design.
   2. Pressure, Air, Water, Gas: 3 percent of design.
   3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
   4. Relative Humidity: 4 percent of design.
   5. Barometric Pressure: 0.1 inch of Hg.
   6. Flow Rate, Air: 10 percent of design.
   7. Flow Rate, Water: 4 percent of design.
   8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to University of South Carolina.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to University of South Carolina.

END OF SECTION

SECTION 01 9114

COMMISSIONING AUTHORITY RESPONSIBILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Authority's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests performed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to University of South Carolina are complete: Detailed O&M data submittals are specified.
   4. Verify that the University of South Carolina's operating personnel are adequately trained: Formal training conducted by Contractor is specified.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 SUBMITTALS

A. Commissioning Plan:
   1. Submit preliminary draft for review by University of South Carolina and Architect within 30 days after commencement of Commissioning Authority contract.
   2. Submit revised draft to be included in the construction contract documents, not less than 4 weeks prior to bid date.
   3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. List of Prefunctional Checklists to be developed:
   1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
   3. Submit final list not more than 60 days after start of construction.

C. Prefunctional Checklists:
   1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised draft for review by University of South Carolina and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
   3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

D. List of Functional Test procedures to be developed:

1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the Contract Documents; this is intended to be a list of titles, not full description of the tests.
3. Submit final list not more than 60 days after start of construction.

E. Functional Test Procedures:
1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised draft for review by University of South Carolina and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

F. Training Plan.

G. Commissioning Record: Submit to Contractor for inclusion with O&M manuals.

H. Final Commissioning Report: Submit to University of South Carolina.

I. Recommissioning Manual: Submit within 60 days after receipt of University of South Carolina's instructions to proceed with preparation.

J. LEED Reports: Submit Final Commissioning Report and Recommissioning Manual in accordance with procedures specified in Section 01 3515.

PART 3 EXECUTION

2.01 COMMISSIONING PLAN

A. Prepare and maintain the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.
1. Call and chair meetings of the Commissioning Team when appropriate.
2. Give Contractor sufficient notice for scheduling commissioning activities.
3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
4. The PECI Model Commissioning Plan may be used as a guide for the Commissioning Plan.
5. ASHRAE Guideline 1 may be used as a guide for the Commissioning Plan.
6. Avoid replication of information included in the construction contract documents to the greatest extent possible.

B. Review the construction contract documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.

C. Commissioning Schedule:
1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
2. Contractor's scheduling responsibilities are specified in the construction contract documents.
3. Revise and re-issue schedule monthly.
4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

2.02 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction contract documents; review and submit comments to University of South Carolina.
1. These specifications include:

a. Procedures applicable to all types of items to be commissioned.

2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction contract documents by Architect:
   a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
   b. Additional University of South Carolina personnel training.
   c. Additional operation or maintenance data that should be submitted.

B. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.
   1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.
   2. The Checklist forms are intended to be part of the Contractor's Contract Documents.

C. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by University of South Carolina and Architect.
   1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.
   2. The forms the Commissioning Authority will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.

D. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction contract documents.

E. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction contract documents

2.03 PREFUNCTIONAL CHECKLISTS

A. Prefunctional Checklists - Content: Prepare forms for Contractor's use, in sufficient detail to document that the work has been installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup.
   1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.
   2. Identify each Checklist by using the contract documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.
   3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.
   4. Include space to record manufacturer name, model number, serial number, capacity and other relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.
   5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.
   6. Include line items for each physical inspection to be performed.
   7. Include line items for each operational inspection to be performed, such as checking switch operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
   8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
   9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.

B. Prefunctional Checklists - Format:

1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
2. Include on cover sheet space for Contractor's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
   a. "This Checklist is submitted for approval with no exceptions."
   b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

2.04 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to show that functional performance is in accordance with the Contract Documents and shows proper operation through all modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load.
   1. Obtain assistance and review by installing subcontractors.
   2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
   3. Include test setup instructions, description of tools and apparatus, special cautions, and.
   4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
   5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
   6. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.

B. Functional Test Report Forms: Prepare forms in advance of testing, using a consistent format; include all test procedure information given to Contractor and:
   1. Report Identifier (see Documentation Identification Scheme).
   2. Test prerequisites.
   3. Formulas to be used in calculations.
   4. Yes/No check boxes for each step of test.
   5. Space to record results, document deficiencies, and make recommendations.
   6. Signature and date block for Commissioning Authority.

C. Functional Test Prerequisites: Include space to verify all of the following items on each Functional Test Report Form, unless truly inapplicable:
   1. All related equipment has been started up and start-up reports and Prefunctional Checklists submitted and approved ready for Functional Testing.
      a. For hydronic systems, check that:
         1) Piping system flushing is complete and required report approved.
         2) Water treatment system is complete and operational.
         3) Test and balance (TAB) is complete and approved.
   2. All control system functions for this and all interlocking systems are programmed and operable in accordance with the Contract Documents, including final set points and schedules with debugging, loop tuning and sensor calibrations completed, with space for signature of controls installer.
   3. Incomplete items identified by Architect during closeout inspections have been corrected or completed.

4. Safeties and operating ranges have been reviewed.
5. A copy of the specified sequence of operation is attached.
6. A copy of applicable schedules and setpoints is attached.
7. A copy of the specified Functional Test Procedures is attached.
8. The Functional Test Procedures have been reviewed and approved by the applicable installer.
9. Vibration control report approved (if required).
10. False loading equipment, system and procedures ready.
11. Sufficient clearance around equipment for servicing.
12. Original values of pre-test setpoints that need to be changed to accommodate testing have been recorded, with a check box provided to verify return to original values (include control parameters, limits, delays, lockouts, schedules, etc.).
13. Any other items on the Prefunctional Checklist or Start-up Reports that need to be re-verified.

2.05 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Contractor and Construction Manager, ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review commissioning activities and responsibilities with all parties involved. Require attendance by all members of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and University of South Carolina personnel; hold meetings at least monthly.

E. Submit periodic progress reports to University of South Carolina and Contractor.

F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that University of South Carolina's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.

I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.

L. HVAC Commissioning:
   1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
   2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
   3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
   4. Review TAB Plan prepared by Contractor.

5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
7. Analyze trend logs and monitoring data to verify performance.

M. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control systems, tests contracted directly by University of South Carolina, and tests by manufacturer's personnel; include documentation in O&M manuals.

N. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Authority rather than the Contractor, perform such testing without assistance of Contractor.

O. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

P. O&M Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.

Q. Notify Contractor and University of South Carolina of deficiencies in procedures or results; suggest solutions.

2.06 TRAINING

A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor.
1. Include a ____ hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.
2. Include a ____ hour session by the Commissioning Authority on the use of the blank Prefunctional Checklists and Functional Test report forms for re-commissioning purposes.
3. Establish criteria for determining satisfactory completion of training.

B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.

2.07 CLOSEOUT

A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.
1. Include the Final Commissioning Plan and Final Report.
2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
a. Design intent documentation, furnished by Architect or others.
b. Detailed operational sequences.
c. Startup plan and approved startup reports.
d. Filled out Prefunctional Checklists.
e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
f. Training plan and training records.
g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.

B. Final Commissioning Report: Include:
1. Executive summary.
2. List of participants and roles.
3. Brief facility description.
4. Overview of commissioning scope and general description of testing and verification methods.
5. For each item commissioned, an evaluation of adequacy of:
a. The product itself; i.e. compliance with the contract documents.
b. Installation.

c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
d. O&M documentation, including design intent.
e. Operator training.

6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

2.08 POST-OCCUPANCY PHASE

A. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.

B. On-Site Review: 10 months after Substantial Completion conduct on-site review with University of South Carolina's staff.

1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
3. Make suggestions for improvements and for recording these changes in the O&M manuals.
4. Identify areas of concern that are still under warranty or are the responsibility of the original construction contractor.
5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

END OF SECTION

SECTION 03 4500
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete wall panels and exterior wall caps..

B. Supports, anchors, and attachments.

C. Intermediate and perimeter joint seals.

D. Grouting under panels.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Perimeter joints with sealant and backing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, integral insulation, insulated panel system connectors, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.

D. Samples: Submit two precast samples, 12 x 12 inch in size, illustrating surface finish, color and texture.

E. Fabricator qualifications.

F. LEED Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete, mix design(s) used showing the quantity of Portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used; use LEED New Product Content Form.

G. Maintenance Data: Indicate surface cleaning instructions.

1.05 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.

B. Fabricator Qualifications:
   1. Firm having at least 2 years of documented experience in production of precast concrete of the type required.
   2. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.

C. Welder: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

1.06 MOCK-UP

A. Construct free standing mock-up, * feet long by * feet wide, with lifting device, and attachment points, and finish in accordance with approved sample.* Note the mock-up configuration elevation and section on the drawings

B. Include in the precast concrete panel mock-up with typical window, fully glazed, sealants, and brick veneer.

C. Locate on site.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete:
   1. Carolina Cast Stone_____.
   2. Coreslab Structures_____.
   3. Metromont_____.
   4. Gate Precast Company
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRECAST UNITS

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
   1. Concrete Face Mix: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent; comply with ACI 301.
   2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   3. Calculate structural properties of units in accordance with ACI 318.
   4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance with light acid etched finish

2.03 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 40 (280).
   1. Deformed billet-steel bars.

B. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain type.
   1. Coiled Rolls.
   2. Mesh Size: 6 x 6.
   3. Wire Gage: 1.4 x 1.4__.

2.04 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Structural Aggregates: ASTM C33.

C. Surface Finish Aggregate: Clean, washed natural gravel; ____ inch size, _____ color, from single source throughout conforming to ASTM C33.

D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
   1. Concentration: Base dosage rates on weight of Portland cement, fly ash, silica fume, and other cementitious materials but not aggregate or sand.
   2. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).

E. Water: Clean and not detrimental to concrete.

F. Fiber Reinforcement: Synthetic fiber shown to be resistant to long-term deterioration when exposed to moisture and alkalis; 1/2 inch length.

G. Grout:
   1. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

2.05 SUPPORT DEVICES

A. Connecting and Support Devices: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
   1. Clean surfaces of rust, scale, grease, and foreign matter.
   2. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.

B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563 (A 563M) nuts and matching washers.

C. Primer: Zinc rich type.

2.06 ACCESSORIES

A. Bearing Pads: High density plastic; Shore A Durometer ____; 1/8 inch thick, smooth both sides.

B. Sealant: S-1 type specified in Section 07 9005.

C. Water Repellant: Water based Siloxane breathable penetrating concentrate. Manufacturer's Prosoco "Sure Klean Weather Seal Siloxane WB Concentrate or compariable by Evonik Degussa or BASF Construction chemicals

2.07 FABRICATION

A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.

B. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

C. Maintain consistent quality during manufacture.

D. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

E. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

F. Locate hoisting devices to permit removal after erection.

G. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

H. Apply water repellant in accordance with manufacturers instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. Weld units in place. Perform welding in accordance with AWS D1.1/D1.1M.

E. Provide non-combustible shields during welding operations.

F. Touch-up field welds and scratched or damaged primed painted surfaces.

G. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.

H. Seal perimeter and intermediate joints in accordance with Section 07 9005.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135, except as specifically amended below.
   1. Plan Location from Building Grid Datum: Plus or minus 3/8 in.
   2. Top Elevation from Nominal Top Elevation: Plus or minus 3/8 inch.
   3. Maximum Plumb Variation Over Height of Structure or 100 ft (whichever is less): Plus or minus 1/2 inch.
   4. Exposed Joint Dimension: Plus or minus 3/16 inch.
   5. Maximum Jog in Alignment of Matching Faces or Edges: Plus or minus 3/16 inch.
   6. Differential Bowing or Camber as Erected Between Similar Adjacent Members: Plus or minus 3/16 inch.

END OF SECTION

SECTION 04 0511
MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Installation of mortar and grout.

B. Section 04 2001 - Masonry Veneer: Installation of mortar.

C. Section 08 1113 - Hollow Metal Doors and Frames: Products and execution for grouting steel door frames installed in masonry.

1.03 REFERENCE STANDARDS

A. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2005.

B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2013.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2012.

H. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

J. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.

K. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.

L. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2013.

M. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013.

N. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2012.

O. ASTM E518 - Standard Test Methods for Flexural Bond Strength of Masonry; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C 270 and test and evaluation reports per ASTM C 780.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. Mortar Mix Designs: ASTM C270, Property Specification.

2.02 MATERIALS

A. Masonry Cement: ASTM C 91, Type S or M.

B. Portland Cement: ASTM C150, Type I - Normal; standard gray color.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar - Brick veneer only: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C 979.
   1. Color(s): U.S. Ivory Buff 12B as manufactured by Blue Circle. (Note: Color to match adjacent USC Academic Enrichment Center and USC Athletic Coaches Support Building.)

G. Water: Clean and potable.

2.03 MORTAR MIXES

A. Mortar for Unit Masonry: ASTM C270, Property Specification.
   1. Masonry below grade and in contact with earth: Type S or M.
   2. Exterior, loadbearing masonry: Type S or M.
   3. Exterior, non-loadbearing masonry: Type S or O.
   4. Interior, loadbearing masonry: Type S or M.
   5. Interior, non-loadbearing masonry: Type O.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

2.04 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

2.05 GROUT MIXES

A. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
   1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
   2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.06 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

2.07 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 4000.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
   1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
   1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

PART 3 EXECUTION

3.01 PREPARATION

A. Plug clean-out holes for grouted masonry with block masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

D. Do not displace reinforcement while placing grout.

E. Remove excess mortar from grout spaces.

3.03 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of contract documents.

B. Grouting:
   1. Limit height of pours as indicated in Structural Notes
   2. Limit height of masonry to 16 inches above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 4000.

B. Test and evaluate mortar in accordance with ASTM C780 procedures.

C. Test and evaluate grout in accordance with ASTM C1019 procedures.

D. Prism Tests: Test masonry and mortar panels for compressive strength in accordance with ASTM C1314, and for flexural bond strength in accordance with ASTM C1072 or ASTM E518; perform tests and evaluate results as specified in individual masonry sections.

END OF SECTION

SECTION 04 2001
MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clay Facing Brick.

B. Reinforcement and Anchorage.

C. Flashings.

D. Installation of Lintels.

E. Accessories.

1.02 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2013.

E. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2013.

F. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.06 MOCK-UP

A. Construct a free standing mock-up which includes veneer masonry panel sized as indicated feet long by as indicated feet include masonry veneer, mortar and accessories in mock-up.

B. Locate as indicated on drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

1.08 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Manufacturers:
   1. Boral Bricks, Inc: www.boralbricks.com.
   2. Palmetto Brick Company_____.
   3. Hanson Brick

B. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Color and texture: Equal to Palmetto Brick Company 75 Greystone Modular. Architect
   2. Nominal size: 7 5/8 x 2 1/4 x 3 1/2 inch.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
   4. Provide solid brick units i locations where holes otherwise be exposed.

2.02 MORTAR MATERIALS

A. Mortar and Grout: As specified in Section 04 0511.

2.03 REINFORCEMENT AND ANCHORAGE

A. Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.

2.04 FLASHINGS

A. EPDM Flashing: ASTM D4637/D4637, Type I, 0.040 inch thick.

B. Stainless Steel: ASTM A666, Type 304, soft temper; 26 gage (0.45 mm) thick; finish 2B to 2D.

C. Lap Sealant: Butyl type as specified in Section 07 9005.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc (including Dur-O-Wal brand): www.h-b.com.
      b. WIRE-BOND: www.wirebond.com.
      c. Masonry Reinforcing Corporation of America
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Weeps: Molded PVC grilles, insect resistant.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc; Product ____: www.h-b.com.
      b. WIRE-BOND; Product ____: www.wirebond.com.
      c. Masonry Reinforcing Corporation of America
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Cavity Vents: Polyester mesh.

1. Manufacturers:
   a. Blok-Lok Limited; Product ____: www.blok-lok.com.
   b. CavClear/Archovations, Inc; CavClear Weep Vents: www.cavclear.com
   c. Substitutions: See Section 01 6000 - Product Requirements.

D. Drainage Fabric: Polyester mesh.
1. Manufacturers:
   a. Substitutions: See Section 01 6000 - Product Requirements.

E. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Mortar Diverter: Panels installed at flashing locations.
   a. Manufacturers:
      1) Advanced Building Products, Inc._____.
      2) Mortar net USA. Product 2" wide x 10" tall.
      3) Substitutions: See Section 01 6000 - Product Requirements.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Brick Units:
1. Bond: Running unless noted otherwise on drawings
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar as work progresses.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.

3.05 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

D. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Lap joint reinforcement ends minimum 6 inches.

D. Masonry Back-up; Secure veneer anchors to masonry back-up and embed into masonry veneer at the spacing indicated in the Structural Notes on the drawings. Place additional anchors at perimeter of openings and ends of walls, so maximum spacings of anchors is 8 inches on center.

E. Stud Back-up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at the spacing indicated in the Structural Notes on the drawings. Place additional anchors at perimeter of openings and ends of wall, so maximum spacing of anchors is 8 inches on center.

3.07 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 4 inches into adjacent masonry or turn up at least 4 inches to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend metal flashings through exterior face of masonry and turn down to form drip.

C. Extend EPDM and Stainless Steel flashings to within 1/4 inch of exterior face of masonry.

D. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

3.08 LINTELS

A. Install loose steel lintels over openings.

B. Maintain minimum 8 inch bearing on each side of opening.

3.09 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joint in accordance with Section 07 9005 for sealant performance.

D. Form expansion joint as detailed.

3.10 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

3.11 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

D. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
   2. Documentation of Credit MR 5: Submit applicable LEED Submittal Form for each different product or component which has been extracted, recovered, or manufactured within 500 miles of the project site.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.

C. Plates: ASTM A283.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, plain.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
   2. Rungs: one inch diameter solid round bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.

B. Bumper Posts and Guard Rails: As detailed; prime paint finish.

C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

E. Lintels: As detailed; galvanized finish.

F. Sill Angles for Rods Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

G. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

H. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

I. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.05 FINISHES - STEEL

A. Prime paint all steel items.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated .

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 5100
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Monumental Stairs with concrete treads to receive rubber treads

B. Prefabricated exterior service stairs with grating treads and platforms.

C. Structural steel stair framing and supports.

D. Handrails and guards.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's stamp or seal on each sheet of shop drawings.

C. Delegated Design Data: As required by authorities having jurisdiction.

D. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
   2. Documentation of Credit MR 5: Submit applicable LEED Submittal Form for each different product or component which has been extracted, recovered, or manufactured within 500 miles of the project site.

1.03 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.01 METAL MONUMENTAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Concrete Reinforcement: None.
   5. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
   1. Nosing Depth: Not more than 1-1/2 inch overhang.
   2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: _____.

H. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.02 METAL SERVICE STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Industrial, as defined above.

B. Risers: Open.

C. Treads: Steel bar grating.
1. Grating Type: Welded.
2. Bearing Bar Depth: 3/4 inch, minimum.
3. Top Surface: Standard.
4. Nosing: Checkered plate.
5. Nosing Width: 1-1/4 inch, minimum.
6. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Stringers: Rolled steel channels.
1. Stringer Depth: 10 inches.
2. End Closure: Sheet steel of same thickness as risers welded across ends.

E. Railings: Steel pipe railings.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.

B. Guards:
1. Top Rails: Round pipe or tube rails unless otherwise indicated.
a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
2. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
a. Outside Diameter: 1 inch.
b. Material: Steel pipe or tube, round.
c. Vertical Spacing: Maximum 4 inches on center.
d. Jointing: Welded and ground smooth and flush.
3. End and Intermediate Posts: Same material and size as top rails.
a. Horizontal Spacing: As indicated on drawings.
b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501 structural tubing, round and shapes as indicated.

C. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

E. Gratings: Bar gratings complying with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

F. Concrete Fill: Type specified in Section 03 3000.

G. Steel Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.05 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.
   2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Exterior balcony railings and guardrails.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
   2. Documentation of Credit MR 5: Submit applicable LEED Submittal Form for each different product or component which has been extracted, recovered, or manufactured within 500 miles of the project site.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

C. Allow for expansion and contraction of members and building movement without damage to connections or members.

D. Dimensions: See drawings for configurations and heights.

E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   3. For anchorage to stud walls, provide backing plates, for bolting anchors.

F. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Straight Splice Connectors: Steel concealed spigots.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 7300
DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior railing and guardrail assemblies.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

D. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

E. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
   2. Documentation of Credit MR 5: Submit applicable LEED Submittal Form for each different product or component which has been extracted, recovered, or manufactured within 500 miles of the project site.

F. Maintenance Data: Manufacturer's instructions for care and cleaning.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in University of South Carolina's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing glazed railing systems and acceptable to manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver railing materials in factory provided protective coverings and packaging.

B. Protect railing materials against damage during transit, delivery, storage, and installation at site.

C. Inspect railing materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

D. Prior to installation, store materials and components under cover, in a dry location.

1.05 FIELD CONDITIONS

A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.

B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

1.06 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Cable Railings and Guardrails at Monumental Stair and Balcony:
   1. Mogg Constructive Inc. or equal
   2. Other manufacturers may bid railing system with similar design components after receiving approval by Architect during bid period.

2.02 RAILING SYSTEMS

A. Decorative Cable Railings and Guardrails at Monumental Stair and Balcony:
   Basis of Design: Mogg ZeMer and Mogg ZeX General: Factory- or shop-fabricated in design indicated and the 2006 International Building Code, (whichever is more stingent), to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
   1. Design Criteria: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
      a. Lateral Force: 75 lb minimum, at any point, when tested in accordance with ASTM E935.
      b. Distributed Load: 50 pounds per foot (Linear foot), minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E 935.
      c. Concentrated Loads on Intermediate Rails: 50 pounds per square ft, minimum.
      d. Concentrated Load: 200 pounds minimum, applied in any direction at any point along the handrail or guardrail system, when tested in accordance with ASTM E 935.
   2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
   3. Joints: Tightly fitted and secured, machined smooth with hairline seams.
   4. Field Connections: Provide sleeves to accommodate site assembly and installation.
   5. Welded Joints: Make exposed joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
      a. Ease exposed edges to small uniform radius.
   6. Vertical Posts: Stainless Steel, Model Number SS563-SR. Side mount posts. Provide concealed steel spacers as required to anchor mounting plate back to steel structure.
   7. Railing Bracket: Stainless Steel Model Number SS114-L3 with 2" tall vertical pin.
   8. Handrail and Guardrail: 1 1/2" OD Stainless Steel. No. 4 satin finish.
   9. Refer to elevations and sections for additional detail.

2.03 MATERIALS

A. Steel Components:
   1. Decorative Steel Sections: Hot-rolled steel C1010.

2.04 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth and polished to be invisible.

B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
   3. For anchorage to stud walls, provide backing plates for bolting anchors.
   4. Exposed Fasteners: No exposed bolts or screws.

C. Finish Touch-Up Materials: As recommended by manufacturer for field application.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION

A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.

B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.

F. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with grout.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. Field Services: Provide the services of the manufacturer for field observation of installation of railings.

3.06 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.07 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-structural dimension lumber framing.

B. Marine Grade Plywood sheathing

C. Roofing nailers.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.FIRE RETARDANT TREATED WOOD IS NOT PERMITTED ON THIS PROJECT.

F. Communications and electrical room mounting boards.

G. Miscellaneous wood nailers, furring, and grounds.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. LEED: Submittals; Product Data foor Credit EQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.

1.03 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Southern Pine, unless otherwise indicated.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing: Extruded polystyrene foam plastic, ASTM C 578, Type IV; tongue and groove long edges; 1 inch thick.Water resistant tape all joints.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Other Applications:

1. Pressure treated 3/4" thick plywood concealed from view at roof parapet, etc. but located within exterior enclosure: PS 1, C-C plugged or better, exterior grade.
2. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
1. Manufacturers:
a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
b. Viance, LLC: www.treatedwood.com.
c. Osmose, Inc: www.osmose.com.
d. Substitutions: See Section 01 6000 - Product Requirements.
2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
b. Treat lumber exposed to weather.
c. Treat lumber in contact with roofing, flashing, or waterproofing.
d. Treat lumber in contact with masonry or concrete.
3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
b. Treat plywood in contact with roofing, flashing, or waterproofing.
c. Treat plywood in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. Specifically, provide the following non-structural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.

4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Install construction panels where indicated on drawings.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.06 TOLERANCES

A. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Specially fabricated wood lockers

C. Countertops.

D. Cabinet hardware.

E. Shelf Standards, Brackets and plywood shelving.

F. Toilet Room Lavatory fabrications.

G. Adhesive applied plastic laminate panels to gypsum board.

H. Wood panel inserts for undercounter appliance to match cabinetry.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit IEQ 4.4: For composite wood products and adhesives, documentation indicating that products contain no urea formaldehyde.
3. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

B. Perform cabinet construction in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum Five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.06 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Hardwood Lumber: NHLA; Graded in accordance with, Grade I/Premium; average moisture content of 5-10 percent; species as follows:
   1. Exposed Surfaces - Stained with transparent finish: Species Mahogany; plain sawn.
   2. Exposed Surfaces - Painted finish: Species Poplar; plain sawn.

2.04 PANEL MATERIALS

A. Veneer Faced Plywood Finish: HPVA HP-1; graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, core of veneer (wood plies), particleboard, medium density fiberboard, or engineered combination of core materials listed; type of glue recommended for specific application; thickness as required; face veneer as follows:
   1. Exposed Surfaces: Grade A, Mahogany, plain sliced, book-matched.
   2. Semi-Exposed Surfaces: Grade A, Mahogany, plain sliced, book-matched.

B. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.

C. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with interior grade adhesive to suit application; sanded faces; thickness as required.

D. Plywood for Non-Decorative Purposes: NIST PS 1, Interior rated adhesives, core of wood plies from listed species unless otherwise indicated, thickness as indicated or as required by application.
   1. Semi-Exposed Surfaces: APA B-B Grade, rotary cut Douglas fir face veneer.
   2. Concealed Surfaces: PS 1; APA B-B Grade, rotary cut Douglas fir face veneer.

E. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for other components indicated on drawings.

2.05 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation: www.formica.com.
   2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.
   3. Wilsonart International, Inc: www.wilsonart.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide specific types as scheduled.
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
   3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, colors as scheduled, finish as scheduled.

2.06 COUNTERTOPS

A. Plastic Laminate Countertops (C-5): Medium density fiberboard, with exterior glue, substrate covered with HPDL, conventionally fabricated and self-edge banded.

B. Solid Surface Countertops (C-1, C-2, C-3): Where noted on Drawings. Homogeneous quartz composite; sheet material. Minimum 3/4 inch thickness, refer to Drawings for thickness. Color: Refer to Finish Schedule.
   1. Manufacturer: Refer to Finish Schedule.
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. Veneer Faced Plywood Finish Countertops (C-4): HPVA HP-1; graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, core of veneer (wood plies); type of glue recommended for specific application; thickness as required; face veneer as follows:
   1. Exposed Surfaces: Grade A, Match flooring F-9, for veneer species, veneer cut and color .

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding at Break Room and Work Room Cabinetry: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
   1. Color: As selected by Architect from manufacturer's standard range.

C. Glass: Type A as specified in Section 08 8000.

D. Fasteners: Size and type to suit application.

E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

F. Concealed Joint Fasteners: Threaded steel.

G. Grommets: Standard plastic or rubber grommets for cut-outs, in color to match adjacent surface.

H. Shelf Standards and Brackets:
   1. Extra-heavy adjustable standards and brackets. Adjustable in 1 inch increments, double slotted design. Anochrome finish.
   2. Standards: 16 gage steel; size as indicated on Drawings.
   3. Brackets: 14 gage steel; size as indicated on Drawings.
   4. Accessories: Provide shelf connector bracket; 2 per bracket
   5. Knape & Vogt 85 Series Standard and 185 Series Bracket.

2.08 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.

D. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finishsteel with satin finish.

F. Glass Stand-offs: Aluminum rod with threaded fasteners at each end and matching decorative cap. Doug Mockett & Company, Inc. Series "MPB" height as indicated on Drawings.

G. Cable Grommets: 2 inch diameter, unless noted otherwise on drawings, with removable cap. Plastic construction; similar to Doug Mocket and Company, Inc.; Style TG; www.mockett.com.

H. Drawer Slides:
   1. Type: Standard extension.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.

5. Features: Provide self closing/stay closed type.
6. Products:
   a. Accuride International, Inc: www.accuride.com.
   b. Grass America Inc: www.grassusa.com.
   c. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
   d. Substitutions: See Section 01 6000 - Product Requirements.

I. Hinges: European style concealed self-closing type, BHMA No. 626, steel with polished finish.
   1. Products:
      a. Grass America Inc: www.grassusa.com.
      b. Hardware Resources: www.hardwareresources.com.
      c. Julius Blum, Inc: www.blum.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

J. Countertop support bracket: Flat plate steel, prime painted "L" shape. Hidden from view when installed. "Freedom Bracket" by Federal Brace Company; Belmont NC; www.federalbrace.com.

K. Closet Rods and Accessories: Hafele American Company
   1. Rod: 501.23.200
   2. Closet Rod Support: 805.39.202 chrome finish.
   3. End Brackets: 803.52.200 chrome finish

2.09 FABRICATION

A. Cabinet Style: Flush overlay.

B. Cabinet Doors and Drawer Fronts: Flush style.

C. Drawer Construction Technique: Lock shoulder joints.

D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

E. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

F. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

G. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.

H. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.10 FACTORY FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 5, System 5; Conversion Varnish, Transparent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

C. Verify that steel has been installed in walls to support toilet room lavatories.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

G. Site glaze glass materials using the Interior Dry method specified in Section 08 8000.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 4216
WOOD-VENEER PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom wood veneer paneling for pilasters in the Lobby Area.

B. Solid wood panel trim.

C. Shop finishing.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, surface graining elevations of sheet paneling, fastening methods, joining methods, and interruptions to other work, to a minimum scale of 1-1/2 inch to 1 ft. Include plan of panel number sequencing.

C. Product Data: Provide data on fire retardant treatment materials and application instructions.

D. Samples: Submit two samples of finished plywood, 6 x 6 inch in size, illustrating wood grain and specified finish.

E. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit IEQ 4.4: For composite wood products and adhesives, documentation indicating that products contain no urea formaldehyde.
   3. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum three years of documented experience.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire retardant requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

B. Do not deliver wood materials to project site until building is fully enclosed and interior temperature and humidity are in accordance with recommendations of AWI//AWMAC/WI Architectural Woodwork Standards.

PART 2 PRODUCTS

2.01 PANELING

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

2.02 WOOD-BASED MATERIALS - GENERAL

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Hardwood Lumber: NHLA; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade I/Premium; average moisture content of 5-10 percent; species as follows:
   1. Exposed Surfaces - Stained with transparent finish: Species Mahogany; plain sawn.

2.04 SHEET MATERIALS

A. Veneer Faced Plywood Finish: HPVA HP-1; graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, core of veneer (wood plies), particleboard, medium density fiberboard, or engineered combination of core materials listed; type of glue recommended for specific application; thickness as required; face veneer as follows:
   1. Exposed Surfaces: Grade A, Mahogany, plain sliced, book-matched.

2.05 ADHESIVES AND FASTENERS

A. Adhesives: Type suitable for intended purpose, complying with applicable air quality regulations.

B. Fasteners: Of size and type to suit application; plain finish in concealed locations.

2.06 ACCESSORIES

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content

B. Wood Filler: Tinted to match surface finish color.

2.07 FABRICATION

A. Fabricate to AWI/AWMAC Quality Standards Illustrated Premium quality, of Flush design.

B. Fabricate panels with book matching between adjacent leaves.

C. At panels more than one leaf high, fabricate with continuous sequenced end matching.

D. Shop prepare and identify panels for grain matching during site erection.

E. Prepare panels for delivery to site, permitting passage through building openings.

F. Finish exposed edges of panels as specified by grade requirements.

G. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify adequacy of backing and support framing.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.

B. Do not begin installation until wood materials have been fully acclimated to interior conditions.

C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.

D. Where necessary to cut and fit on site, scribe work abutting other components. Do not use additional overlay trim to conceal gaps.

E. Coordinate the installation of firestopping behind paneling.

F. Set exposed fasteners, fill with wood filler, and finish to match panel finish.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 1400
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid applied membrane waterproofing.

B. Cant strips and other accessories.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in University of South Carolina's name and registered with manufacturer.

1.03 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Provide an additional 2% of quantity of installed pavers for future replacment.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of fluid-applied waterproofing membranes with three years experience.

B. Installer Qualifications: Company specializing in installation of fluid-applied waterproofing with minimum five years experience.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to University of South Carolina.

C. Provide ten year manufacturer warranty for waterproofing failing to resist penetration of water , except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Rubberized Asphalt Manufacturers:

B. Hot-Applied Rubberized Asphalt Waterproofing Manufacturers:

1. Tremco Commercial Sealants & Waterproofing: Product Tremproof 6100
2. American Hydrotech, Inc; Product Monolithic Membrane 6125EV: www.hydrotechusa.com.
3. Carlisle Coatings & Waterproofing, Inc; Product CCW-500R: www.carlisle-ccw.com.
4. W.R. Meadows, Inc; Product _____: www.wrmeadows.com.
5. American Permaquik, Inc.; Product Permaquik 6100.

6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WATERPROOFING APPLICATIONS

A. Hot-Applied Rubberized Asphalt Waterproofing: Use at Recruiting Deck 301A.
   1. Cover with protection board.

2.03 MEMBRANE AND FLASHING MATERIALS

A. Hot-Applied Rubberized Asphalt Waterproofing: Elasticized rubberized asphaltic compound, hot-applied and quick setting.
   1. Thickness:
      a. Unreinforced: 180 mils minimum thickness.
      b. Reinforced: 215 mils thickness.
   2. Suitable for installation over concrete, gypsum board, and plywood substrates.
   3. Tensile Strength: 15 psi, measured in accordance with ASTM D412.
   4. Ultimate Elongation: 1000 percent, measured in accordance with ASTM D 5329.
   5. Hardness: 60, measured in accordance with ASTM D2240, using Type A durometer.
   6. Tear Strength: 150 lbf/inch, measured in accordance with ASTM D624.
   7. Water Vapor Permeance: 0.2 perms, maximum, measured in accordance with ASTM E96/E96M.
   8. Adhesion: Greater than 150 psi, measured in accordance with ASTM D4541.

2.04 ACCESSORIES

A. Surface Conditioner: Asphaltic Concrete type, compatible with membrane compound; as recommended by membrane manufacturer.

B. Sealant for Substrate Surfaces: As recommended by membrane manufacturer.

C. Protection Course: Fiberglass reinforced rubberized asphalt sheet; 85 mils thick. Hydroflex 30 manufactured by American Hydrotech.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

D. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions. Vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Seal cracks and joints with sealant using methods recommended by sealant manufacturer.

E. Install cant strips at inside corners.

3.03 INSTALLATION

A. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness.

B. Apply primer or surface conditioner at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

C. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.

1. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
2. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.

D. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and ____ inches at subsequent plies laid in shingle fashion.

E. Apply extra thickness of waterproofing material at corners, intersections, and angles.

F. Extend waterproofing material and flexible flashing into drain clamp flange, apply adequate coating of liquid membrane to assure clamp ring seal. Coordinate with drain installation in Division 22.

G. Seal membrane and flashings to adjoining surfaces. Install termination bar at all edges. Install counterflashing over all exposed edges.

3.04 INSTALLATION - PROTECTION BOARD

A. Immediately after cooling, dust membrane with tack-reducing surfacing at rate of approximately 10 lbs/100 sq ft.

3.05 FIELD QUALITY CONTROL

A. University of South Carolina will provide testing services in accordance with Section 01 4000 - Quality Requirements. Contractor shall provide temporary construction and materials for testing.

B. On completion of horizontal membrane installation, dam installation area in preparation for flood testing.

C. Flood to minimum depth of 1 inch with clean water. After 48 hours, inspect for leaks.

D. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test. Repair damage to building.

E. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 1900
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior masonry surfaces.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and University of South Carolina.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.05 MOCK-UP

A. Prepare a representative surface 36 by 36 inch in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

B. Locate where directed.

1.06 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane/Siloxane Water Repellents:
   1. BASF Construction Chemicals: www.buildingsystems.basf.com.
   2. Pecora Corporation: www.pecora.com.
   3. PROSOCO, Inc; Product Siloxane WB Concentrate: www.prosoco.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two.
   3. VOC Content: As specified in Section 01 6116.
   4. Products: Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry; minimum 20 percent nonvolatile content.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until precast concrete substrate is cured a minimum of 60 days.

D. Remove loose particles and foreign matter.

E. Scrub and rinse surfaces with water and let dry.

F. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply two coats, minimum.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, and over roof deck and exterior wall.

B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene board.

B. Insulation Inside Masonry Cavity Walls: Extruded polystyrene board.

C. Insulation Over Metal Stud Framed Walls, Continuous: Extruded polystyrene board.

D. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

E. Insulation Over Roof Deck: Polyisocyanurate board.

F. Building Wrap over all rigid insulation boards in all exterior walls.

2.02 FOAM BOARD INSULATION AND BUILDING WRAPS MATERIALS

A. Extruded Polystyrene Board Insulation: ASTM C578, Type X; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Board Size: 48 x 96 inch.
   4. Board Thickness: varies in inches. See drawings for thickness required.
   5. Board Edges: Square.
   6. Compressive Resistance: 15 psi.
   7. Water Absorption, maximum: 0.3 percent, volume.
   8. Manufacturers:
      a. Dow Chemical Co: www.dow.com.
      b. Owens Corning Corp: www.owenscorning.com.
      c. Pactiv Building Products: greenguard.pactiv.com.
   9. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.

1. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
2. Manufacturers:
   a. CertainTeed Corporation: www.certainteed.com.
   b. Johns Manville Corporation: www.jm.com.
   c. Owens Corning Corp: www.owenscorning.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Place 6 inch wide building wrap sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

A. Installation of board insulation over low slope roof deck is specified in Section 07 5423.

3.06 BATT INSTALLATION

A. Install insulation with building wrap in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape insulation batts in place.

G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

I. Tape seal tears or cuts in vapor retarder.

J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.07 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2726

FLUID-APPLIED MEMBRANE WEATHER AIR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes fluid-applied, vapor-permeable membrane weather barriers.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:
   1. Product Data for Credit EQ 4.2: For weather-barrier products, documentation including printed statement of VOC content.

C. Shop Drawings: For weather-barrier assemblies.
   1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.04 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.
   1. Build integrated mockups of exterior wall assembly as shown on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of weather barriers, and sealing of gaps, terminations, and penetrations of weather-barrier assembly.
      a. Coordinate construction of mockups to permit inspection by Owner's testing agency of weather barrier before external insulation and cladding are installed.
      b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.02 PERFORMANCE REQUIREMENTS

A. General: Weather barrier shall be capable of performing as a continuous vapor- retarding weather barrier. Weather-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.03 VAPOR-RETARDING MEMBRANE WEATHER BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Weather Barrier: Elastomeric, modified bituminous membrane.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Elastomeric, Modified Bituminous Membrane:

1) Carlisle Coatings & Waterproofing Inc.; Barriseal S.
2) Epro Services, Inc.; Ecoflex-S.
3) Henry Company; Air-Bloc 06 QS.
4) Hohmann & Barnard, Inc.; Textroflash Liquid.
5) Meadows, W. R., Inc.; Air-Shield LM.
6) Tremco Incorporated, an RPM company; ExoAir 120SP/R.

2. Physical and Performance Properties:
   a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
   b. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.

2.04 ACCESSORY MATERIALS

A. General: Accessory materials recommended by weather-barrier manufacturer to produce a complete weather-barrier assembly and compatible with primary weather-barrier material.

B. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

C. Termination Mastic: Weather-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Mask off adjoining surfaces not covered by weather barrier to prevent spillage and overspray affecting other construction.

B. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

C. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

3.02 INSTALLATION

A. General: Install fluid-applied membrane weather-barrier and accessory materials according to weather-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous weather barrier.
   1. Coordinate the installation of weather barrier with installation of roofing membrane and base flashing to ensure continuity of weather barrier with roofing membrane.
   2. Install weather-barrier assembly on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid weather-barrier material on same day. Reprime areas exposed for more than 24 hours.

C. Connect and seal exterior wall weather-barrier material continuously to roofing-membrane weather barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of weather barrier to substrate with termination mastic.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transitions and flashing so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of weather-barrier material with foam sealant.

G. Seal weather-barrier assembly around masonry reinforcing or ties, precast concrete supports, and penetrations with termination mastic.

H. Seal top of through-wall flashings to weather barrier.

I. Fluid-Applied Membrane Material: Apply a continuous unbroken weather-barrier membrane to substrates according to the following thickness. Apply weather-barrier membrane in full contact around protrusions such as masonry ties.
   1. Vapor-Retarding Membrane Weather Barrier: Total 40-mil dry film thickness, applied in the number of coats recommended by manufacturer.

J. Do not cover weather barrier until it has been tested and inspected by Owner's testing agency.

K. Correct deficiencies in or remove weather barrier that does not comply with requirements; repair substrates and reapply weather-barrier components.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Weather-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.

C. Tests: As determined by Owner's testing agency from among the following tests:
   1. Qualitative Air-Leakage Testing: Weather-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186.
   2. Quantitative Air-Leakage Testing: Weather-barrier assemblies will be tested for air leakage according to ASTM E 783.

D. Weather barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional weather-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient weather-barrier components for retesting as specified above.

E. Repair damage to weather barriers caused by testing; follow manufacturer's written instructions.

F. Protect weather-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect weather barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace weather barrier or install additional, full-thickness, weather-barrier application after repairing and preparing the overexposed membrane according to weather-barrier manufacturer's written instructions.
   2. Protect weather barrier from contact with incompatible materials and sealants not approved by weather-barrier manufacturer.

G. Remove masking materials after installation.

END OF SECTION

SECTION 07 4264

METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal faced composite panels with mounting system. Panel mounting system including anchorages, furring, fasteners, gasket and sealants, related flashing adapters and masking for a complete installation.

B. Parapet coping, column covers, soffits, sills, border and filler items to be as integral components of the panels system.

C. All flashing metal required shall be by the panel manufacturer.

D. System to be fabricated and installed per local code requirements.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
   3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
   4. Review procedures for protection of work and other construction.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Wall System Manufacturer Qualifications.

C. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.

D. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.

E. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

F. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

G. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

H. Installer’s Qualifications.

I. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

J. Maintenance Data: Care of finishes and warranty requirements.

K. Executed Warranty: Submit warranty and ensure that forms have been completed in University of South Carolina's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of Work and licensed in the State in which the Project is located.

B. Wall System Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
   1. With not less than three years of documented experience.
   2. Approved by MCM sheet manufacturer.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. With minimum 3 years of documented experience.
   2. Approved by wall system manufacturer.

D. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

E. Mock-Up: Provide a mock-up for evaluation of fabrication workmanship.
   1. Locate as indicated on drawings.
   2. Provide panels finished as specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of any accumulated water.
   4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F.
   5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Wall System Warranty: Provide joint written warranty by manufacturer and installer, agreeing to correct defects in manufacturing or installation within a one year period after Date of Substantial Completion.

C. ACM Sheet Manufacturer's Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for ten (10) years:
   1. Chalking: No more than that represented by a No.8 rating based on ASTM D4214.
   2. Color Retention: No fading or color change in excess of 5 Hunter color difference units, calculated in accordance with ASTM D2244.
   3. Gloss Retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material Sheet Manufacturers:
   1. Alcan Composites USA, Inc: www.alucobondusa.com.
   2. Alcoa Reynobond, Inc: www.alcoa.com.
   3. ALPOLIC Materials; ALPOLIC Natural Metals: www.alpolic-usa.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Panel System Manufacturers:
   1. C. R. Laurence Co., Inc; _____: www.crl-arch.com.
   2. Firestone Metal Products, LLC; _____: www.unaclad.com.
   3. Reynobond Aluminum Composite Material; www.alcoa.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
   1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
   2. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
   3. Anchor panels to supporting framing without exposed fasteners.
   4. System type: Rout-and-Return Dry System: Fabricator and installer must provide an engineered pressure relief system including extruded perimeter frame, drainage gutter, all extrusions, clips, fasteners, anchors, trim, flashings, gaskets, sealant, etc.

B. Performance Requirements:
   1. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
   2. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
      a. Design Wind Pressure: As specified in Refer to Drawings..
      b. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
      c. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.
   3. Air Infiltration: 0.06 cfm/sq ft of wall area, maximum, when tested at 1.57 psf in accordance with ASTM E283.
   4. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf minimum, after 15 minutes.
      a. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
      b. Design to drain leakage and condensation to the exterior face of the wall.

C. Panels: Approximately 2 inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
   1. Reinforce corners with riveted aluminum angles.
   2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
   3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
   4. Metallic Finished Panels: Maintain consistent grain of MCM sheet; specifically, do not rotate sheet purely to avoid waste.
   5. Fabricate panels under controlled shop conditions.
   6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
   7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
      a. Make panel lines, breaks, curves and angles sharp and true.
      b. Keep plane surfaces free from warp or buckle.
      c. Keep panel surfaces free of scratches or marks caused during fabrication.
   8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
   9. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

2.03 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a solid core of standard polyethylene core (PE) formed in a continuous process with no glues or adhesives between dissimilar materials; core material free of voids and spaces; no foamed insulation material content.
   1. Panel Thickness: RB160 4 mm.=0.157"
   2. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
   3. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.Class A
   4. Flammability: Self-ignition temperature of 650 degrees F or greater, when tested in accordance with ASTM D1929.
   5. Finish: Factory finished highly polished Class I natural anodized finish; AAMA 620 AA-M12C22A41, anodic coating not less than 0.7 mils thick. Color: Natural Brushes Aluminum with Durabrite C clear protective sealant.
   6. Finish: #4 Brushed Aluminum.

B. Attachment System Components:
   1. Formed from extruded aluminum.
   2. Include manufacturer's standard perimeter extrusions with integral weather stripping and panel stiffeners.

C. All aluminum flashings required shall be provided by the panel manufacturer.

D. Anchors, Clips and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A480/A480M, ASTM A276 or ASTM A666.

E. Fasteners:
   1. Exposed fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   2. Bolts: Stainless steel.

F. Joint Sealer: Silicone sealant to match panel, as approved by MCM sheet manufacturer.

G. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of ACM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

H. Replace damaged products.
   1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
   2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.04 FIELD QUALITY CONTROL

A. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

B. Site Observation Visits: Schedule two site visits during execution of installation.

3.05 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Protect installed panel system from damage during construction.

END OF SECTION

SECTION 07 5423

THERMOPLASTIC-POLYOLEFIN ROOFING (TPO)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermoplastic membrane roofing system, including all components specified.

B. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at http://manual.fsbp.com.

C. Commencement of work by Contractor shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

C. Section 22 1006 - Plumbing Specialties: Roof drains

1.03 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

B. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2009.

C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2010.

D. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting; 2009.

E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2011a.

F. PS 1 - Structural Plywood; 2009.

G. PS 20 - American Softwood Lumber Standard; 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
   2. Notify Architect well in advance of meeting.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.

C. Samples: Submit samples of each product to be used.

D. Executed Warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Roofing installer shall have the following:
   1. Current approval, license, or authorization as applicator by the manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store materials clear of ground and moisture with weather protective covering.

C. Keep combustible materials away from ignition sources.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

C. Warranty: 20 year Limited Warranty covering membrane, roof insulation, and other indicated components of the system, for the term indicated.
   1. Limit of Liability: No dollar limitation.
   2. Scope of Coverage: Repair leaks in the roofing system caused by:
      a. Ordinary wear and tear of the elements.
      b. Manufacturing defect in materials.
      c. Defective workmanship used to install these materials.
      d. Damage due to winds up to 90 mph.
   3. Not Covered:
      a. Damage due to winds in excess of 90 mph.
      b. Damage due hurricanes or tornadoes.
      c. Hail.
      d. Intentional damage.
      e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carlisle SynTec Incorporated

B. Firestone Building Products Company

C. Sarnafi Inc.

D. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic olefin (TPO) single-ply membrane 60 mil.
   1. Membrane Attachment: Fully adhered.
   2. Warranty: Full system warranty; Firestone 20 year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
   3. Comply with applicable local building code requirements.

2.03 MEMBRANE MATERIALS

A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D6878, with polyester weft inserted reinforcement and the following additional characteristics:
   1. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C1549.
   2. Color: White.

B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches wide.

D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
   1. Thickness: 0.060 inch plus/minus 10 percent.
   2. Tensile Strength: 1550 psi, minimum, when tested in accordance with ASTM D638 after heat aging.
   3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D638 after heat aging.
   4. Tearing Strength: 12 lbf, minimum, when tested in accordance with ASTM D1004 after heat aging.
   5. Color: White.
   6. Acceptable Product: UltraPly TPO Flashing by Firestone.

E. Tape Flashing: 5-1/2 inch nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch nominal; TPO QuickSeam Flashing by Firestone.

F. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.

G. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

H. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick; Firestone Termination Bar by Firestone.

I. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant by Firestone.

J. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant by Firestone.

K. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing by Firestone.

2.04 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C1289 Type II Class 1, with the following additional characteristics:
   1. Thickness: As indicated elsewhere.
   2. Size: 48 inches by 96 inches, nominal.
      a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
   3. R-Value: R-30
   4. Compressive Strength: 20 psi when tested in accordance with ASTM C1289.
   5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
   6. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.

2.05 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
   1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
   2. Thickness: Same as thickness of roof insulation.

PART 3 INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where

manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.

D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.04 INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.

3.05 SINGLE-PLY MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Install membrane adhered to the substrate, with edge securement as specified.

E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.

F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
   1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
   2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.06 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
   1. Follow roofing manufacturer's instructions.
   2. Remove protective plastic surface film immediately before installation.
   3. Install water block sealant under the membrane anchorage leg.
   4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
   5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
   6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
   7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

3.07 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

B. Perform all corrections necessary for issuance of warranty.

3.08 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.09 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Aluminum: ASTM B209 (ASTM B209M); 0.032 inch thick; anodized finish of color as selected.
   1. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils thick.

B. Stainless Steel: ASTM A666 Type 304, soft temper, 0.015 inch thick; smooth No. 4 finish.

2.02 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Sealant: Type B-1 specified in Section 07 9005.

E. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

B. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

C. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 7200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured curbs, equipment rails, and pedestals.

B. Roof Hatch.

C. Folding Roof Guardrail

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS

A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
   1. AES Industries Inc.: www.aescurb.com.
   2. The Pate Company: www.patecurbs.com.
   3. Roof Products & Systems (RPS) by Commercial Products Group of Hart & Cooley, Inc: www.rpscurbs.com.

B. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
   1. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
   2. Provide the layouts and configurations shown on the drawings.

2.02 ROOF HATCHES

A. Manufacturers:
   1. Bilco Co.: www.bilco.com.
   2. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.

B. Manufacturers - Roof Hatches:
   1. Dur-Red Products: www.dur-red.com.
   2. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.

C. Roof Hatches: Factory-assembled steel frame and cover, complete with operating and release hardware.
   1. Style: Provide flat metal covers unless otherwise indicated.
   2. Mounting: Provide frames and curbs suitable for mounting on flat roof deck.
   3. Size(s): As indicated on drawings; single-leaf style unless indicated as double-leaf.
   4. For Ladder Access: Single leaf; 30 by 36 inches.

D. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Galvanized steel, 14 gage, 0.0747 inch thick.

2. Finish: Factory prime paint.
3. Insulation: 1 inch rigid glass fiber, located on outside face of curb.
4. Curb Height: 12 inches from finished surface of roof, minimum.

E. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch thick, liner 22 gage, 0.03 inch thick.
3. Finish: Factory prime paint.
4. Insulation: 1 inch rigid glass fiber.
5. Gasket: Neoprene, continuous around cover perimeter.

F. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.
7. Provide a telescopic pole for the user grip while ascending from the hatch.

2.03 FOLDING GUARDRAILSYSTEM

A. Folding Guardrail
1. Atlantic Fall protection by StealthRail 2000 Guardrail System:
2. ICB System Barrail Products
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Standards: System shall top and middle rails in accordance with OSHA Standards 29 CFR 1910.23 and 29 CFR 1926.502

C. Structural Load: 200 pounds minimum, in any directions to all components in accordance with OSHA Regulations 29 CFR 1910.23 and 29 CFR 1926.502

D. Height: 42 inches minimum.

E. Railings: 1-5/8 inch O.D> hot rolled picked electric weld tubing free of sharp edges and snag points.

F. Mounting Bases: Class 30 gray iron iron material cast with four receiver posts.

G. Reciever Posts: provide positive locking system into slots.

H. Hardware: Securing pins zinc palted yellow chromate dipped.

I. Finishes: Standard Powder Coat Yellow.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

B. All to be installed securely and watertight

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For firestopping, including printed statement of VOC content and chemical components.

E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

F. Certificate from authority having jurisdiction indicating approval of materials used.

1.03 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. With minimum 3 years documented experience installing work of this type.
   2. Able to show at least 5 satisfactorily completed projects of comparable size and type.
   3. Licensed by authority having jurisdiction.
   4. Approved by firestopping manufacturer.

1.04 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.02 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and T Rating Equal to F Rating and that meets all other specified requirements.

2.03 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

C. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg .
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

D. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

E. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

I. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Silicone joint sealants.

B. Urethane joint sealants.

C. Latex joint sealants.

D. Preformed joint sealants.

E. Acoustical joint sealants.

F. Butyl Sealant

1.02 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers eight samples of materials that will contact or affect joint sealants. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. 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.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

D. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.

E. Product test reports.

F. Preconstruction compatibility and adhesion test reports.

G. Preconstruction field-adhesion test reports.

H. Field-adhesion test reports.

I. Warranties.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Preinstallation Conference: Conduct conference at Project site.

1.05 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period - Silicone Sealants: 20 years from date of Substantial Completion.
   2. Warranty Period all other sealants: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.02 SILICONE JOINT SEALANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. BASF Building Systems.
   2. Dow Corning Corporation.
   3. GE Advanced Materials - Silicones.
   4. Pecora Corporation.
   5. Sika Corporation; Construction Products Division.
   6. Tremco Incorporated.

B. Type S-1; Silicone Joint Sealant: ASTM C 920.
   1. Type: Single component (S) or multicomponent (M).
   2. Grade: Nonsag (NS).
   3. Class: 100/50.
   4. Uses Related to Exposure: Nontraffic (NT).

C. Type S-2; Silicone Joint Sealant: ASTM C 920.
   1. Type: Single component (S) or multicomponent (M).
   2. Grade: Pourable (P) or nonsag (NS).
   3. Class: 100/50.
   4. Uses Related to Exposure: Traffic (T).

D. Type S-3; Mildew-Resistant Silicone Joint Sealant: ASTM C 920.
   1. Type: Single component (S).
   2. Grade: Nonsag (NS).
   3. Class: 50.
   4. Uses Related to Exposure: Nontraffic (NT).

E. Type S-4; Structural Silicone Glazing Sealant: ASTM C 920.
   1. Type: Single component (S).

2. Grade: Nonsag (NS).
3. Class: 50.
4. Uses Related to Exposure: Nontraffic (NT).
5. Dow Corning 995 Silicone Structural Glazing Sealant.

2.03 URETHANE JOINT SEALANTS

A. Type U-1; Urethane Joint Sealant: ASTM C 920.
1. Type: Single component (S) or multicomponent (M).
2. Grade: Pourable (P) or nonsag (NS).
3. Class: 100/50.
4. Uses Related to Exposure: Traffic (T).

2.04 BUTYL SEALANTS

A. Type B-1; Butyl or polyisobutylene Joint Sealant: ASTM C 1311.
1. Type: Single componant (S).
2. Grade: Non-drying, non-skinning and non-curing.

2.05 LATEX JOINT SEALANTS

A. Type L-1; Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. BASF Building Systems.
b. Bostik, Inc.
c. Pecora Corporation.
d. Schnee-Morehead, Inc.
e. Tremco Incorporated.

2.06 ACOUSTICAL JOINT SEALANTS

A. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Pecora Corporation.
b. USG Corporation.

2.07 JOINT SEALANT BACKING

A. 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.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.08 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.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
   1. Remove laitance and form-release agents from concrete.
   2. 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.

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.

3.02 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. 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.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

G. 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.

3.03 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 1 test for each 1000 feet of joint length thereafter or 1 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.

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.

3.04 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
a. Construction joints in cast-in-place concrete.
b. Joints in dimension stone cladding.
c. Joints between metal panels.
d. Joints between different materials listed above.
e. Perimeter joints between materials listed above and frames of doors, storefront, curtain wall and louvers.
2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical or horizontal non-traffic surfaces.
1. Joint Locations: Sheet metal flashing movement joints.
2. Joint Sealant: Butyl or polyisobutylene.
3. Joint Sealant Color: Black.

C. Joint-Sealant Application: Exterior joints in vertical curtain wall surfaces.
1. Joint Locations: Curtain wall structural glazing joints.
2. Joint Sealant: Silicone.
3. Joint Sealant Color: Black.

D. 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.
2. Joint Sealant: Urethane.
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.
1. Joint Locations:
a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
d. Other joints as indicated.
2. Joint Sealant: 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 Sealant Location:
a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated.

2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location: Acoustical joints where indicated.
2. Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel doors and frames.

B. Steel frames for wood doors.

C. Fire-rated steel doors and frames.

D. Thermally insulated steel doors.

E. Steel glazing frames.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:
   1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
   2. De La Fontaine Inc; Hollow Metal Frame ____ Profile: www.delafontaine.com.
   3. Republic Doors; Product ____: www.republicdoor.com.
   4. Steelcraft, an Allegion brand; Product ____: www.allegion.com/us.
   5. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   1. Accessibility: Comply with ANSI/ICC A117.1.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   4. Door Texture: Smooth faces.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.

7. Galvanizing All exterior locations: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors :
1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
2. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.

B. Interior Doors, Non-Fire-Rated:
1. Grade: ANSI A250.8 Level 1, physical performance Level C, Model 1, full flush.
2. Thickness: 1-3/4 inches.

C. Interior Doors, Fire-Rated:
1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
a. Provide units listed and labeled by UL.
b. Attach fire rating label to each fire rated unit.

2.04 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door, except:
a. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage
2. Finish: Same as for door.

B. Exterior Door Frames: Face welded, seamless with joints filled.
1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire-Rated: Knock-down type.

D. Interior Door Frames, Fire-Rated: Knock-down type.
1. Fire Rating: Same as door, labeled.

E. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08 8000, factory installed.

B. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Coordinate installation of hardware.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. LEED Submittals:
   1. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

D. Specimen warranty.

E. Test Reports: Show compliance with specified requirements for the following:

F. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.

G. Samples: Submit two samples of door construction, 6 by 6 inch in size cut from top corner of door.

H. Samples: Submit two samples of each stain color, up to 6 different colors, applied to door veneer, 6 by 6 inch inch in size illustrating wood grain, stain color, and sheen.

I. Manufacturer's Installation Instructions: Indicate special installation instructions.

J. Warranty, executed in University of South Carolina's name.

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:

B. Wood Veneer Faced Doors:
   1. Graham Wood Doors: www.grahamdoors.com.
   2. Eggers Industries: www.eggersindustries.com.
   3. Haley Brothers: www.haleybros.com.
   4. Marshfield Door Systems, Inc: www.marshfielddoors.com.

5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. All Doors: See drawings for locations and additional requirements.
   1. Quality Level: Premium Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
   2. Quality Level: Premium Grade, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.
   3. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at all locations .
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252, UL 10B, or UBC Standard 7-2-94 ("neutral pressure"); UL or WH (ITS) labeled without any visible seals when door is open.
   3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch w.g. pressure at both ambient and elevated temperatures; with "S" label; if necessary, provide additional gasketing or edge sealing.
   4. Wood veneer facing with factory stain and transparent finish .

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: Mahogany, veneer grade as specified by quality standard, plain sliced, book veneer match, center balance assembly match; unless otherwise indicated.
   1. Vertical Edges: Same species as face veneer.
   2. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.

B. Facing Adhesive: Type I - waterproof.

2.05 ACCESSORIES

A. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.

2.06 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
   1. Exception: Doors to be field finished.

E. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:

B. Factory finish doors in accordance with specified quality standard:

1. Transparent Finish: Stain with transparent conversion varnish, Custom quality, satin sheen.

C. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 4126

ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All-glass interior storefronts.

B. All-glass interior swinging doors.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
   1. Require attendance by representatives of installer.
   2. Notify Architect four calendar days in advance of scheduled meeting date.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each component in all-glass entrance assembly.

C. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

D. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
   1. Include field measurements of openings.
   2. Include elevations showing:
      a. Appearance of all-glass entrance layouts.
      b. Locations and identification of manufacturer-supplied door hardware and fittings.
      c. Locations and sizes of cut-outs and drilled holes for other door hardware.
   3. Include details of:
      a. Requirements for support and bracing at openings.
      b. Installation details.
      c. Appearance of manufacturer-supplied door hardware and fittings.
   4. Schedule: Listing of each type component in all-glass entrance assemblies, cross-referenced to shop drawing plans, elevations, and details.

E. Verification Samples: Two samples, minimum size 2 by 3 inches, representing actual material and finish of exposed metal.

F. Certificates: Contractor's certification that installer of entrance assemblies meets specified qualifications.

G. Operation and Maintenance Data: For manufacturer-supplied operating hardware.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Minimum three years of experience installing entrance assemblies similar to those specified in this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

PART 2 PRODUCTS

2.01 ASSEMBLIES

A. Storefront: Factory fabricated assemblies consisting of frameless glass panels fastened with metal structural fittings in configuration indicated on the drawings.

1. Operational Loads: Designed to withstand swinging door operation under normal traffic without damage, racking, sagging, or deflection.
2. Prepared for all specified hardware whether specified in this section or not.
3. Finished metal surfaces protected with strippable film.
4. Factory assembled to greatest extent practicable; may be disassembled to accommodate shipping constraints.

B. Swinging Door Fittings and Hardware:
1. Top and bottom pivots concealed in full width rails top and bottom.
2. Single Doors: Floor mounted door stop.

2.02 FITTINGS

A. Exposed Fittings and Hardware: Extruded aluminum, clear anodized finish.

B. Fixed Glazed Panel Fittings: Sufficient to structurally support glazing and doors under specified loads; including but not limited to cover caps for door hardware, clamp fittings, and 4" continuous top and bottom rail to match door. At selected openings with transoms provide 2 inch bottom fitting at transom above door.

C. Sidelight Fittings: No rails; provide extruded aluminum channels, for recessed installation in construction above and below glazing panels for frameless appearance.

D. Swinging Door Fittings: Continuous 4 inch top and bottom rail at door.
1. Rail Cross-Section: 1-3/4 inches wide by 4 inch high. At selected doors with transoms provide 2 inch top rail at door.
2. Rail Profile: Square.

2.03 DOOR HARDWARE

A. Finish of Exposed Metals: Match finish of fittings. Brushed or satin aluminum.

B. Swinging Door Hardware: Provided by storefront manufacturer:
1. Top pivot and double acting floor closer. Closer to be Rixson Model 40 Center Hung or equal. Fully recessed.
2. Top and bottom rails in brushed or satin aluminum finish.
3. Connecting plates to connect individual glass panels as required.
4. Locking mechanism on bottom rail; cylinder provided under Division 08 Section "Door Hardware".

C. All Other Door Hardware: Specified in Section 08 7100.

2.04 MATERIALS

A. Glass: Tempered float glass meeting requirements of ASTM C1036, Type I, Quality Q3, fully tempered in accordance with ASTM C1048, Kind FT, and as follows:
1. Thickness: 1/2 inch.
2. Color: Clear, Class 1.
3. Prepare glazing panels for indicated fittings and hardware before tempering.
4. Polish edges that will be exposed in finished work to bright flat polish.
5. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

B. Aluminum Components: Conforming to ASTM B221 (ASTM B221M), Alloy 6063, Temper T5.

C. Sealant: One-part silicone sealant, conforming to ASTM C920, clear.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are acceptable.

B. Do not begin installation until substrates and openings have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean substrates thoroughly prior to installation.

B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Tolerances:
   1. Horizontal Components and Sight Lines: Not more than 1/8 inch in 10 feet variation from level, non-cumulative.
   2. Vertical Components and Sight Lines: Not more than 1/8 inch in 10 feet variation from plumb, non-cumulative.
   3. Variation from Plane or Indicated Location: Not more than 1/16 inch.

C. Installation of door hardware not supplied by entrance/storefront manufacturer is specified in Section 08 7100.

3.04 ADJUSTING

A. Adjust doors to operate correctly, without binding to frame, sill, or adjacent doors.

B. Adjust door hardware for smooth operation.

3.05 CLEANING

A. Clean installed work to like-new condition.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 7100

FINISH DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Definition: "Finish Hardware" includes items known commercially as finish / security hardware and systems which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

B. Extent of finish / security hardware required is indicated on drawings and in schedules.

C. Types of finish hardware required include, but are not limited to, the following:
   1. Butt Hinges
   2. Continuous Hinges
   3. Lock cylinders and keys
   4. Lock and latch sets
   5. Exit devices
   6. Pull units/Custom Pulls
   7. Closers
   8. ADA Operators and actuators
   9. Door trim units
   10. Weather stripping for exterior doors
   11. Protection plates
   12. Thresholds, Gaskets, and Door Bottoms
   13. Key Cabinet
   14. Electrified Hardware
   15. Coat Hooks at office doors

D. References
   1. NFPA-80-207 - Standard for Fire Doors and Windows
   2. NFPA-101-2003 - Life Safety Code
   3. NFPA - 70 - National Electric Code
   4. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
   5. ANSI-A 117.1-American National Standards Institute - Accessible and Usable Buildings and Facilities
   6. ANSI-A156.5-American National Standards Institute - Auxiliary Locks and Associated Products
   7. International Building Code as Adopted
   8. Positive Pressure Testing UL10C & UBC7.2
   9. UL - Underwriters Laboratories
   10. WHI - Warnock Hersey International, Division of Inchscape Testing Services
   11. State, Local and Federal Codes, National Electrical Building Codes, including the Authority Having Jurisdiction

1.04 QUALITY ASSURANCE

A. Manufacturer: Obtain each type of hardware (ie., lock sets / security equipment) from a single manufacturer, although several may be indicated as offering products complying with requirements.

B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the project's vicinity for a period of not less than 4 years. The supplier shall be, or shall employ, a certified Architectural Hardware Consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to the Owner, Architect and the Contractor. The certified architectural hardware consultant (AHC) shall prepare all hardware and wiring diagrams. This Supplier is responsible for proper coordination of all finished hardware with related sections to insure compatibility of products.

C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware, which has been tested and listed by UL / WHI or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Provide door seals to meet Positive Pressure Testing UL10C and UBC7 - 2 as required.

D. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL / WHI or FM label on exit devices indicating "Fire Exit Hardware".

E. Thru bolt door closers and exit devices, except at doors from Board Room 104. Verify and coordinate proper blocking is provided from the door manufacturer for hardware attachment in these doors.

F. Unless otherwise specified, provide lever handle locksets ADA compliant.

G. Pre-Installation Meeting: The Contractor shall initiate and conduct a jobsite meeting with the hardware supplier and the Installer, and all related trades for mechanical and electrical hardware. This meeting shall convene at least one month prior to commencement of the related work, specifically, the electrical rough-in for coordination of electrified hardware applications. All approved shop drawings, wiring diagrams, and schedules shall be made available to all related trades as required for work to be performed. The Owner's representative shall attend all pre-install meetings. In addition to reviewing and coordination, the hardware supplier shall, with the assistance of the manufacturer's representative, provide review/training to the Installers of the following products prior to installation of these products: closers, exit devices, locks, and electrified hardware.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.

B. Hardware Schedule: Submit copies of schedule in accordance with Division 1 - “Submittals”, General Requirements. Schedule to be in vertical format, listing each door opening, including: Keying Information, handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door openings as intended, and finish of hardware. At doors with door closers or door controls, include degree of door opening. All submittals (schedules, cut sheets, diagrams) shall be reviewed by the Owner prior to ordering of material. Supply the schedules and all templates within two (2) weeks from date purchase order is received by the door openings supplier. Furnish wiring diagrams (elevation, riser, and point-to-point) for all electrified hardware.
   1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into a vertical format with "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
      a. Type, style, function, size and finish of each hardware item.
      b. Name and manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of hardware set cross-referenced to indications on
      e. Drawings both on floor plans and in door and frame schedule.
      f. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
      g. Mounting locations for hardware.
      h. Door and frame sizes and materials.
      i. Keying information.

C. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames), which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.

D. Keying Schedule: Submit separate detailed schedule after meeting with the Owner to determine the Owner's instructions for keying.

E. Samples if Requested: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit any requested samples of type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.

F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location, coordination and installation of hardware.

G. Manufacturer's Catalog Cuts: Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

H. Wiring Diagrams: Provide complete wiring diagrams for each opening requiring electrified hardware. Provide a copy with each hardware schedule submitted after approval. Supply a copy with delivery of hardware to job site and another copy to the Owner at time of job completion. All electrical components to be listed by opening in the hardware submittals.

I. Operational Descriptions: Provide complete operational descriptions of electronic components listed by opening in the hardware submittals. Operational descriptions shall detail how each electrified component functions within the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval. Supply another copy with delivery of hardware to job site and another copy to the Owner upon project completion. Review these descriptions with all related trades at the Pre-Install meetings.

J. Elevation Drawings: Provide elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval. Supply another copy to the Owner upon project completion.

1.06 PRODUCT HANDLING

A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Inventory hardware jointly with the General Contractor, representatives of hardware supplier / hardware installer until each is satisfied that count is correct.

C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

D. The General Contractor shall provide secure lock-up for hardware and security equipment delivered to the project, but not yet installed. Control handling and installation of hardware items, which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.07 SEQUENCING AND SCHEDULING

A. Deliver all finish hardware to the job site in a timely manner so not to delay progress of other trades.

1.08 WARRANTY

A. All Door closer shall include a ten (10) year manufacturers' warranty against defects in materials and workmanship.

B. Exit Devices shall include a three (3) year warranty. ADA operators shall include a two (2) year warranty.

C. Hinges:
1. Life of Building.
2. Electrified Hardware: one (1) year
3. Other Hardware: two (2) years.

PART 2 - PRODUCTS

2.01 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:

B. Manufacturers:

	Hardware Item:		Specified Manufacturer	Designation	
1.	Butts:		Ives		IVE
2.	Continuous Hinges		Ives		IVE
3.	Locksets:		Schlage		SCH
4.	Cylinders/Cores		Best		BES
5.	Silencers:		Ives		IVE
6.	Stops:		Ives		IVE
7.	Overhead Stops		Glynn-Johnson	GLY	
8.	Closers:	LCN		LCN	
9.	Thresholds:		National Guard	NGP	
10.	Gasket/Door Bottoms:		National Guard	NGP	
11.	Kickplates:		Ives		IVE

12. Pull/Push Plates:	Ives		IVE
13. Door Pulls:		Rockwood	ROC
14. Exit Devices:		Von Duprin	VON
15. Flush Bolts:		Ives	IVE
16. Automatic Flush Bolts:		Ives	IVE
17. Magnetic Holders:		LCN	LCN
18. Miscellaneous Hardware:	Ives, Glynn-Johnson		IVE/GLY
19. Key Control:		Telkee	TEL
20. Monitor Strikes; Electric Strikes		Von Duprin	VON
21. Power Supplies Power Transfers:		Von Duprin	VON
22. Door Position Switch; Request		Schlage Electronics	SCE
23. To Exit Switch ADA Operators		LCN	LCN

C. Provide products as hereafter specified. Substitutions other than those manufacturers listed , must be approved, in writing, via addenda, prior to bid. Procedure for substitutions shall be as outlined in Division 1. No substitutions will considered after award of contract.

2.02 MATERIALS AND FABRICATION

A. General:
   1. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
   2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Architect.
   3. Manufacturer's identification will be permitted on rim of lock cylinders only.
   4. Finishes:
      a. 626/652 for all finished metal hardware items except as 630 is otherwise indicated. Door closers to be powder coated to match 652/626. Exit devices shall be US26D with stainless steel touchbars.
   5. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware, which has been prepared for self-tapping sheet metal screws, except, as specifically indicated.
   6. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
   7. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Use thru-bolts for closer and exit devices. Coordinate wood door blocking at all wood doors and all fire-rated wood doors. Provide sleeves for each thru-bolt or use sex screw fasteners.
   8. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.03 HINGES AND BUTTS

A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Screws: Furnish Phillips flat-head or machine screws for installation of units, except furnish Phillips flat-head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   1. Steel Hinges: Steel pins.
   2. Non-ferrous Hinges: Stainless steel pins.
   3. Exterior Doors: Non-removable pins.
   4. Out-swing Corridor Doors: Non-removable pins.
   5. Interior Doors: Non-rising pins.
   6. Tips: Flat button and matching plug, finished to match leaves.
   7. Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.
   8. Acceptable Manufacturers:
      a. Ives 5BB1/5BB1HW.
      b. Hager: BB1279/BB1191/BB1168/BB1199.
      c. Bommer: BB5000/BB5002/BB5004/BB5006.

D. Continuous Hinges: Provide concealed, non-handed, full height hinges with interlocking cover and symmetrically template hole pattern made from extruded aluminum. Finish shall be BHMA 628. minutes). Field modifications for cutting shall be permitted up to 6” from the bottom.
   1. Acceptable Manufacturers:
      a. Ives: 112HD.
      b. Select: SL-11HD.

2.04 LOCK CYLINDERS AND KEYING

A. General: Supplier will meet with Owner to finalize keying requirements and obtain final instructions in writing. Allow for a minimum size system as a Grand Master Key System.

B. Review the keying system with the Owner and provide the type required (master, grandmaster or great-grandmaster).

C. Equip locks and cylinders as 7-pin with construction cores as specified. All cylinders and permanent cores shall be Best Access, keyed to the Owners's existing key system. The hardware supplier shall furnish factory keyed Best cylinders/ cores, and keys per the approved Keying Schedule. All permanent keyed cores and keys shall be shipped directly to the Owner from the Best Access factory. The Owner shall install all permanent keyed cores.

D. Furnish Best temporary construction keyed cores for the construction period of the project. Construction cores shall not be furnished as part of the Owner's existing key system, and shall remain the property of Best Access/the Owner. All construction cores and keys shall be returned to the Owner at project completion. Furnish ten (10) Construction Keys and one (1) control key for the General Contractor's use during project construction.

E. Equip locks with cylinders that comply with performance requirements for Grade 1 cylinders as listed in ANSI A156, and are UL-listed.

F. Permanent keys: for estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys per GMK, 3 control keys.

G. Bitting List: secured shipment direct from Best to the Owner upon completion of project.

H. Visual key control shall be provided on all keys. Visual core control shall be provided on all cores.

I. Key Quantity/ Extras:
   1. 3 each change keys per lock
   2. 5 each master keys for each master group
   3. 3 each grandmaster keys
   4. 3 each control keys
   5. extra keyed cores

2.05 LOCKS, LATCHES AND BOLTS

A. Locksets shall be as specified: Mortise lockset shall be Series 1000 ,Grade 1 Operational and Security, UL Listed for 3-hour fire door. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with ANSI curved lip extended to protect frame, finished to match hardware set. Where specified, provide a replaceable breakaway spindle mechanism residing inside the lock chassis. The lock case shall be full wrapped heavy gauge steel with all metal zinc dichromate plated working parts. Lock case shall be universal function type and allow for field reversible handing without opening the lock case. Lever rotation shall be in both directions for ease of use, and allow for independent lever rotation.
   1. Acceptable Manufacturers:
      a. Schlage L9000 x 17A or L as specified.
      b. Best 45H x 14N.
      c. Falcon M x QG/QN

B. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.

C. Lock Throw: Provide solid stainless steel 1 ½" deadbolt with 1" minimum throw. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

D. Provide 3/4" minimum throw on latch bolts.

E. Flush Bolt Heads: Minimum of 1/2" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.

F. Exit Device Dogging: Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.

2.06 PULLS/ PUSH PLATES

A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation; through-bolted for matched pairs, but not for single units. Furnish type and size as specified in Hardware Sets.

B. Acceptable Manufactures
   1. Rockwood
   2. Ives
   3. Trimco
   4. Forms & Surfaces

2.07 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.

B. Closers: All door closers shall be of one manufacturer to provide for proper installation and servicing after installation. All closers shall be inspected after installation by a factory representative to ensure proper adjustment and operation. A report shall be filed with the architect after said visit has been made. Closer shall carry a manufacturer's TEN YEAR WARRANTY for hydraulic units and 2 year warranty for electrical and/or handicap power assist door closers against manufacturing defects and workmanship. All closers shall be high strength cast iron with one piece forged steel piston. PRV [pressure relief valves] are not acceptable.

C. Parallel Arm Closers: Shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" x 1/2" steel stud shoulder bolts, shall be incorporated in regular arms, hold open arms, arms with stop built in, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, and durability.

D. Built-In Stops: Where closers with built-in positive stops are used, the stops shall be of one piece cast malleable iron material with built in springs. Where required, the hold-open assembly handle for these stops shall rotate on ball bearings.

E. All door closers shall pass UL10C positive pressure fire test.

F. Non-sized: All exterior closers shall be non-sized to provide a full range of Size 1 to 5 closing power, and shall be handed.

G. Hydraulic Fluid: All closers, with the exception of interior electronic closers, shall utilize temperature stable fluid capable of withstanding temperature ranges of 120 degrees F. to -30F. without requiring seasonal adjustment of closer speed to properly close the door. Fluid shall be nonflammable.

H. All closers shall have a powder coat finish on closer body, arm, cover and adapter plate. Furnish special rust inhibiting pretreat coating, as specified, for closer body, arm, cover and plates before the powder coat finish.

I. Provide all drop plates, shoe supports, templates, etc. to properly mount closers according to manufacturers' recommendations.

J. Acceptable Closer Manufacturers:
   1. LCN 4111/4011 series w/ options as specified.

K. ADA Operators: Furnish ADA low energy operators as defined by ANSI Standard A156.19, susch as LCN 4642 series as specified. Operators shall be furnished with both an electronic control system, and a heavy-duty electrically powered hydraulic door closer. Electro--hydraulic operators shall comply with 1990 ADA standard, and shall provide a motor /clutch assembly controlled by a microprocessor based control module to open doors slowly to 90 degrees. The control system shall be designed to provide adjustable opening force, delay times adjustable up to 60 seconds, adjustable closing power, and shall comply with all ADA reduced opening force requirements. Operator shall allow for manual operation for regular pedestrian traffic door with no increased opening resistance from the closer.
   1. Surface Mount, push side mount.
   2. Finish shall be anodized aluminum.
   3. Provide a minimum two year warranty.
   4. Operators shall be field serviceable.
   5. Furnish system complete with components necessary for proper installation, including the operator/closer, actuators at each side of the door opening, connectors, wiring, concealed on/off switch,. Units shall include a built-in powere supply with maximum output load of 1.o amperes @12VDC or 24VAC..
   6. Manufacturer's representative shall conduct installation training for the installer prior to operators being installed. No service contract shall be required.

7. Furnish actuators mounting requirements to all related trades at least one month prior to installation. ADA operator installation instructions, wiring, and mounting requirements shall be reviewed at the project pre-installation meeting.
8. Coordination of ADA operator and security hardware shall be the responsibility of the Hardware Supplier, the Hardware Installer, and the Electrical Contractor..
9. Acceptable Manufacturers:
   a. LCN 4642 series..

2.08 EXIT DEVICES

A. General: All devices shall be of one manufacturer to provide for proper installation and servicing. Devices shall be furnished non-handed and capable of direct field conversion for all available trim functions. All devices shall carry a three year warranty against manufacturing defects and workmanship. All devices shall be push-through touch pad design as specified. No exposed touch bar fasteners, no exposed cavities when operated.

B. Furnish all touch-pad type devices with stainless steel touch bars. Plastic parts are not acceptable. Dogging mechanism shall be mechanical hook type with no plastic dogging cams.

C. Furnish all touch-pad type exit devices with deadlocking latch bolts. Latchbolts shall be moly-coated to reduce friction against the strike.

D. Furnish all touch-pad exit devices with heavy duty metal alloy construction, with horizontal adjustment to provide flush alignment with the device cover plate. End caps shall be flush with device housing with no raised edges.

E. Furnish roller strikes with all rim exit devices.

F. Furnish stabilizers similar to Von Duprin 154 with all removable mullions.

G. Outside Trim: Shall be heavy duty type and fastened by means of concealed welded lugs and thru-bolts from the inside. Trim shall be forged brass with a minimum average thickness on the escutcheon of .130. Plate with trim shall be brass with minimum average thickness of .090 and have forged pulls. Where Lever Handles are specified provide 996 type Break Away Trim. Where outside trim is specified, furnish trim that thru-bolts directly to the exit device center case.

H. Furnish cylinders with all lockable exit devices.

I. Furnish required filler plates and shim kits for flush mounting of exit devices on all doors requiring same.

J. Springs: Compression type only. Torsion springs are not acceptable.

K. Electrified Functions: Electric Latch Retraction shall be provided with a continuous duty solenoid, retracting the latch bolt for momentary latch retraction, or may be held retracted for extended periods of time. Electric operated trim device shall be furnished as Fail-Safe. When the power is off, the trim is unlocked for free entry. The trim may then be relocked electrically by applying power.

L. All exit devices shall be Von Duprin 98 series as specified in the hardware sets.

2.09 DOOR TRIM UNITS

A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops and similar units); either machine screws or self-tapping screws.

B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.

C. Fabricate protection plates (armor, kick or mop) not more than 2” less than door width on stop side and not more than 1” less than door width on pull side, x the height indicated.

D. Metal Plates: Stainless steel, .050" (U.S. 18 ga.), bevel 3 edges: top and both sides.

2.10 GASKETS, DOOR BOTTOMS

A. General: Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf, except where stated the door manufacturer will provide the weatherstripping.. Provide type, sizes and profiles shown or scheduled. Provide non-corrosive fasteners as recommended by manufacturer for application indicated. All gaskets for fire label doors shall comply the door manufacturers label approvals. Fire-label wood doors shall be furnished as “Category A” type with the intumescent seal integral to the door construction.

2.11 THRESHOLDS

A. General: Except as otherwise indicated provide standard aluminum threshold unit of type, size and profile as shown or scheduled.

B. Provide thresholds that are 1” wider than depth of frame.

C. Provide thresholds with return closed ends where specified in Hardware Sets.

2.12 DOOR SILENCERS

A. All hollow metal frames shall have gray resilient type silencers. Quantity (3) on single doors and quantity (2) on pair of doors.

2.13 KEY CONTROL SYSTEM

A. Provide a GHMA Grade 1 Key Control Cabinet complete with two-tag system. The cabinet shall be equal to Telkee, sized for the Project with 50% expansion. Key control system shall include envelopes, labeled tags with self-locking clips, receipt forms, and 3-way visible card index.
   1. Key cabinet and system shall be provided as a part of this contract by the Hardware Supplier. The cabinet shall be indexed and set up by the supplier with the Owner's representative. This set-up process shall be scheduled at least two days prior to the substantial completion date, and coordinate with the Contractor and the Owner.

2.14 ELECTRIFIED HARDWARE

A. Where scheduled, supply electrified function as specified. Electric exit devices shall be furnished with electric latch retraction feature or electrified locking for outside trim. All electric devices shall be free egress at all times. The Access Control System, furnished by the Owner, shall allow for credentials, cardreaders, monitoring, alarms, and client software. All wiring, junction boxes, and final connections for electrified hardware shall be furnished and installed by the electrical contractor.

B. Electrically operated locking devices shall be connected to the building fire and smoke/heat alarm systems. Activation of alarm system shall disengage electric locking mechanism, allowing free, unrestricted egress through opening.

C. Coordinate installation of electrically operated hardware to insure proper size wire is used to power load (s).
   1. Voltage drop shall not exceed 5% of load's stated voltage.
   2. Wire length shall equal distance to load and back to supply (lock 50ft from power supply; wire length = 100 ft.) Two loads powered by on pair of wires draw double current and have half (50%) of resistance.

Wire Size	Resistance Per 1,000 Feet
12 Gauge	1.6 OHM
14 Gauge	2.5 OHM
16 Guage	4.1 OHM
18 Gauge	6.4 OHM
20 Gauge	10.1 OHM
22 Gauge	16.0 OHM

D. Furnish electrically operated hardware with power supply units, junction boxes, and other accessories needed for a complete, efficient installation. Coordinate electrified hardware requirements with all related trades at the Pre-Installation meeting, prior to project electrical rough-in.

E. Components Specified
   1. Power Transfers: Furnish type recessed into the door and frame to allow electrical power to pass from door to frame without the use of door cords or butt type transfer hinges for electric latch retraction function. Furnish manufacturer's back box of zinc dichromated treated steel , both power transfer and thru-wire butt hinge. Back boxes shall be provided to the hollow metal frame manufacture for installation on the frame prior to frame shipped to jobsite.
   2. Electric Strikes: ANSI/BHMA A156.5, Grade 1. Electric strikes shall be listed by UL for fire door accessory and burglary resistance. Strikes shall be for use with mortise locks and rim exit devices, as specified, for hollow metal frame application. Strike operation shall be Fail-Secure. Furnish strike with dual switch monitoring, which allows for two SPDT contacts. One switch shall monitor the tripper which is depressed when the latchbolt is inserted into the strike pocket. The second switch shall monitor the condition of the strike lip: open or closed and locked. Furnish dual switch monitoring as low current.
   3. Power Supply: Furnish type required for the specified electrical function. Power supply shall have regulated output that is field selectable for either 24VDC @ 2 amps or 12VDC @ 4 amps. Standard input at 120VAC @ 1 amp or 240VAC @ 0.5 amp. Power supply unit shall be capable of handling up to 16 amp current inrush to tract exit device latchbolt.
   4. Door Position Switch: Furnish concealed type in frame and door.
   5. Exit Sensors: Furnish devices as a passive infrared detector specifically designated for “request to exit” applications. This device shall have an adjustable relay latch time, and shall be internal pointable, and shall provide two Form “C” sets of relay contacts. Coverage area shall be up to 8 by 10 feet. Coverage shall depend on mounting height and pattern angle. Surface mounting height range shall be from 7 to 15 feet. Relay latch time shall be adjustable up to 60 seconds. The unit shall include an externally visible activation LED.

6. Electro-Magnetic Lock: ANSI/BHMA A156.23. Electro-magnetic locks shall conform to highest classification and allow for both lateral and vertical field adjustment. Locks uses on labeled fire door assemblies shall be listed or labeled by a nationally recognized independent testing laboratory. Locks shall be dual voltage electro-magnets. Operation shall be fail safe, functioning with access control and fire alarm system. Locks shall be surface mounted. Locks shall be equipped with concealed sensors to monitor lock status and door status where needed to interface with the access control system. Provide all mounting accessories as required for the frame and door application, including filler plates, angle brackets, glass door brackets, and in-swing door adaptor brackets as needed for proper installation with hollow metal, wood, aluminum, and glass door and frame assemblies. Acceptable manufacturers: Schalge Electronics: 350 +/320+ series; SDC.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces, which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units, which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

F. Adjust and reinforce attachment substrate for proper installation and operation:
   1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc.

G. Locate floor stops not more than 4 inches from the wall.

H. Certified Installers: Prior to installation of Locksets, Closers, and Exit Devices, hardware installers shall be trained by the manufacturers' representative of each product. This training shall be conducted at the Pre-Installation Meeting at the project site.

3.02 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units, which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative[s] of the Finish Hardware manufacturer[s], shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items, which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of any current or predictable problems (of substantial nature) in the performance of the hardware and furnish copy to Owners Agent / Representative.

3.02 SCHEDULE

HARDWARE SET 01

DOOR NUMBER:

100 100A
101A 100B

EACH TO HAVE:

2	**EA**	**CONTINUOUS HINGE**	**112HD EPT PREP**	**628**	**IVE**
2	**EA**	**POWER TRANSFER**	**EPT-10**	**689**	**VON**
1	**EA**	**MULLION**	**KR4954 8' 6"**	**689**	**VON**
1	**EA**	**PANIC HARDWARE**	**ELRX98EO 3'**	**626**	**VON**
1	**EA**	**PANIC HARDWARE**	**ELRX98NL-OP 3'**	**626**	**VON**
1	**EA**	**RIM CYLINDER**	**1E72**	**626**	**BES**
1	**EA**	**MORTISE CYLINDER**	**1E74 X COLLAR & CAM REQ'D**	**626**	**BES**
2	**EA**	**DOOR PULL**	**RM4440 48" (1-RH 1-LH) TB**	**630**	**ROC**
1	**EA**	**AUTO-EQUALIZER**	**4642**	**689**	**LCN**
1	**EA**	**COMPANION CLOSER**	**4642 X ST3066**	**689**	**LCN**
2	**EA**	**OVERHEAD STOP**	**900S**	**630**	**GLY**
1	**EA**	**THRESHOLD**	**653 72"**	**AL**	**NGP**
1	**EA**	**PS873 OPTION BOARD**	**873-AC**		**VON**
1	**EA**	**POWER SUPPLY**	**PS873-2**	**GRY**	**VON**
1	**SET**	**WIRING DIAGRAMS**	**FURNISH ELEVATION, RISER & POINT TO POINT**		
1			**WEATHERSTRIP BY DOOR MANUFACTURER**		
1	**EA**	**ACTUATOR, WALL MOUNT**	**8310-853**		**LCN**
1	**EA**	**ACTUATOR, WALL MOUNT**	**8310-856**		**LCN**
1	**EA**	**BOLLARD POST**	**8310-866**		**LCN**
1	**EA**	**FLUSH MOUNT BOX**	**8310-868F**		**LCN**

1. ADA OPERATOR SHALL BE SURFACE MOUNTED ON REINFORCED CURTAINWALL FRAMING.
2. COORDINATE ELECTRICAL REQUIREMENTS WITH ALL RELATED TRADES.
3. DOOR FUNCTION: DOORS ARE NORMALLY CLOSED AND SECURE. ENTRY BY CREDENTIAL AT CARDREADER FOR LATCH RETRACTION, OR BY KEY OVERRIDE. LATCHES MAY ALSO BE CONTINUOUSLY HELD RETRACTED FOR FREE ENTRY. ADA OPERATOR SHALL BE AVAILABLE BY USE OF EXTERIOR ACTUATOR WITH CARDREADER ENTRY. FREE EGRESS AND ADA ACTUATOR AT CORRIDOR SIDE. RX SWITCH ALLOWS ALARM FREE EGRESS. DPS RELAYED TO MONITORING WITH THE OWNER'S PROGRAM/SYSTEM.
4. CARDREADER, CREDENTIALS, MONITORING, ALARMS, AND CLIENT

SOFTWARE/PROGRMING SHALL BE FURNISHED BY THE OWNER.
5. WEATHERSTRIP SHALL BE FURNISHED BY THE DOOR MFGR.
6. MOUNT HARDWARE AT SAME ELEVATION A.F.F. AS THE ADJACENT ACADEMIC ENRICHMENT CENTER.
7. COORDINATE LOCATION OF POWER SUPPLY WITH ARCHITECT. CONTRACTOR TO ASSUME POWER SUPPLY WILL BE MOUNTED REMOTELY IN WALL CAVITY FOR FLUSH INSTALLATION OR IT SHALL BE MOUNTED ENTIRELY IN WALL CAVITY BEHIND A FLUSH ACCESS PANEL. REFER TO ARCHITECTURAL DETAILS. CONCEAL WIRING IN WINDOW FRAMING AND IN WALLS.
8. MOUNT BOLLARD POST TO GALVANIZED STEEL ANGLES WITH EMBEDDED ANCHORS BOLT IN CONCRETE SLAB FOR RIGID MOUNTING AT BASE. INSTALL CARD READER IN BOLLARD WITH DOOR ACTUATOR.

HARDWARE SET 02

DOOR NUMBER:
101

EACH TO HAVE:

8	**EA**	**HINGE**	**5BB1 4.5 X 4.5 NRP**	**652**	**IVE**
1	**EA**	**AUTO FLUSH BOLT**	**FB41T (TOP MOUNT ONLY)**	**630**	**IVE**
1	**EA**	**CLASSROOM LOCK**	**L9071L 17L**	**626**	**SCH**
2	**EA**	**MORTISE CYLINDER**	**1E74 X CONSTR CORE X CAM REQ'D**	**626**	**BES**
1	**EA**	**COORDINATOR**	**COR52 X FL20**	**628**	**IVE**
2	**EA**	**MOUNTING BRACKET**	**MB2**	**689**	**IVE**
2	**EA**	**FLOOR CLOSER**	**RIXSON MODEL 40**		
1	**EA**	**WALL STOP**	**WS401CVX**	**626**	**IVE**
2	**EA**	**SILENCER**	**SR64**	**GRY**	**IVE**

HARDWARE SET 03

DOOR NUMBER:
10 6 107
113A 128
129

EACH TO HAVE:

4	**EA**	**HINGE**	**5BB1 4.5 X 4.5**	**652**	**IVE**
1	**EA**	**PRIVACY SET**	**L9040 17L L583-363**	**626**	**SCH**
1	**EA**	**MOP PLATE**	**8400 4" X 1" LDW**	**630**	**IVE**
1	**EA**	**WALL STOP**	**WS401CVX**	**626**	**IVE**
3	**EA**	**SILENCER**	**SR64**	**GRY**	**IVE**
1	**EA**	**COAT HOOK**	**571**	**626**	**IVE**

HARDWARE SET 04

103 104 113 127

EACH TO HAVE:

4	**EA**	**HINGE**	**5BB1 4.5 X 4.5**	**652**	**IVE**
1	**EA**	**OFFICE LOCK**	**L9050L 17L**	**626**	**SCH**
1	**EA**	**MORTISE CYLINDER**	**1E74 X CONSTR CORE X CAM REQ'D**	**626**	**BES**
1	**EA**	**WALL STOP**	**WS401CVX**	**626**	**IVE**
3	**EA**	**SILENCER**	**SR64**	**GRY**	**IVE**
1	**EA**	**COAT HOOK**	**571**	**626**	**IVE**

HARDWARE SET 05

DOOR NUMBER:
102 105A 110
112 115 117
117A 118 121
122 124A 126
126A 130 131
132 133 136
142A

NOTE: NO CLOSERS REQUIRED FOR: 102 110 112 131 142A

EACH TO HAVE:

4	**EA**	**HINGE**	**5BB1 4.5 X 4.5**	**652**	**IVE**
1	**EA**	**OFFICE LOCK**	**L9050L 17L**	**626**	**SCH**
1	**EA**	**MORTISE CYLINDER**	**1E74 X CONSTR CORE X CAM REQ'D**	**626**	**BES**
1	**EA**	**SURFACE CLOSER**	**4011**	**689**	**LCN**
1	**EA**	**KICK PLATE**	**8400 8" X 2" LDW**	**630**	**IVE**
1	**EA**	**WALL STOP**	**WS401CVX**	**626**	**IVE**
3	**EA**	**SILENCER**	**SR64**	**GRY**	**IVE**

HARDWARE SET 06

DOOR NUMBER:
123A

EACH TO HAVE:

4	**EA**	**HINGE**	**5BB1HW 5 X 4.5**	**652**	**IVE**
1	**EA**	**STOREROOM LOCK**	**L9080L 17L**	**626**	**SCH**
1	**EA**	**MORTISE CYLINDER**	**1E74 X CONSTR CORE X CAM REQ'D**	**626**	**BES**
1	**EA**	**SURFACE CLOSER**	**4011 DEL**	**689**	**LCN**
1	**EA**	**KICK PLATE**	**8400 8" X 2" LDW**	**630**	**IVE**
1	**EA**	**WALL STOP**	**WS401CVX**	**626**	**IVE**
3	**EA**	**SILENCER**	**SR64**	**GRY**	**IVE**

HARDWARE SET 07

DOOR NUMBER:
108 109

EACH TO HAVE:

4	**EA**	**HINGE**	**5BB1HW 5 X 4.5 NRP**	**630**	**IVE**
1	**EA**	**FIRE EXIT HARDWARE**	**98L-F 996L-NL 4'**	**626**	**VON**
1	**EA**	**RIM CYLINDER**	**1E72 X CONSTR CORE**	**626**	**BES**
1	**EA**	**SURFACE CLOSER**	**4111 EDA**	**689**	**LCN**
1	**EA**	**WALL STOP**	**WS406CVX**	**630**	**IVE**
1	**SET**	**FIRE SEALS**	**9450B 1/48" 2/96"**	**CHA**	**NGP**
1	**EA**	**DOOR SWEEP**	**601A 48"**	**AL**	**NGP**
3	**EA**	**SILENCER**	**SR64**	**GRY**	**IVE**

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HARDWARE SET 08

DOOR NUMBER:
101B 124

EACH TO HAVE:

1	**EA**	**CONTINUOUS HINGE**	**112HD**	**628**	**IVE**
1	**EA**	**PANIC HARDWARE**	**98NL 3' LD**	**626**	**VON**
1	**EA**	**RIM CYLINDER**	**1E72 X CONSTR CORE**	**626**	**BES**
1	**EA**	**ELECTRIC STRIKE**	**6111 FSE DS-LC 24VDC**	**630**	**VON**
1	**EA**	**SURFACE CLOSER**	**4111 SCUSH SRI**	**689**	**LCN**
1	**SET**	**WEATHER SEALS**	**5050CL 20'**	**CLR**	**NGP**
1	**EA**	**DOOR SWEEP**	**95WH 36"**	**AL**	**NGP**
1	**EA**	**THRESHOLD**	**653- 36"**	**AL**	**NGP**
1	**EA**	**POWER SUPPLY**	**PS861**	**GRY**	**VON**
1	**SET**	**WIRING DIAGRAMS**	**FURNISH ELEVATION, RISER & POINT TO POINT**		
1	**EA**	**BUTTON MINI BOX**	**660-PB**		**SCE**
1	**EA**	**DOOR POSITION SWITCH**	**7764**	**628**	**SCE**
1	**EA**	**REQ TO EXIT SENSOR**	**SCAN II-W**	**WHT**	**SCE**

1. **COORDINATE ELECTRICAL REQUIREMENTS WITH ALL RELATED TRADES.**
2. **DOOR FUNCTION: DOOR SHALL REMAIN CLOSED AND SECURED AND ALARMED. VENDOR-ENTRY. ENTRY ALLOWED BY REMOTE MOMENTARY PUSH BUTTON TO OPEN ELECTRIC STRIKE AND SHUNT ALARM.REMOTE PUSHBUTTON SHALL BE LOCATED AT THE RECEPTION DESK IN THE ELEVATOR LOBBY. AUTHORIZED ENTRY BY CREDENTIAL TO READER OR BY KEYED CYLINDER. PRESENCE SENSOR ALLOWS ALARM FREE EGRESS.**
3. **CARDREADER FOR DOOR 124**

HARDWARE SET 09

123
DOOR NUMBER:

EACH TO HAVE:

4	**EA**	**HINGE**	**5BB1 4.5 X 4.5**	**652**	**IVE**
1	**EA**	**STOREROOM LOCK**	**L9080L 17L**	**626**	**SCH**
1	**EA**	**MORTISE CYLINDER**	**1E74 X CONSTR CORE X CAM REQ'D**	**626**	**BES**
1	**EA**	**SURFACE CLOSER**	**4011 DEL**	**689**	**LCN**
1	**EA**	**KICK PLATE**	**8400 8" X 2" LDW**	**630**	**IVE**
1	**EA**	**WALL STOP**	**WS401CVX**	**626**	**IVE**
3	**EA**	**SILENCER**	**SR64**	**GRY**	**IVE**

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 8 x 8 inch in size of glass units.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.05 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for additional mock-up requirements.

B. Provide mock-up where shown on drawings including glass .

C. Locate where directed.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Type A - Sealed Insulating Glass Units: Vision glazing as indicated on drawings..
   1. Total Thickness: 1 inch.

B. Type C - Sealed Insulating Glass Units: Vision glazing with interior side frosted, refer to drawings
   1. Total Thickness: 1 inch.

C. Type B - Monolitic Glass Units: Fully tempered, refer to drawings.

1. Total Thickness: 1/2 inch (interior only)

2.02 EXTERIOR GLAZING ASSEMBLIES

A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE-7 code.
   1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Thicknesses listed are minimum.

2.03 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Comply with 16 CFR 1201 test requirements for Category II.
   2. Plastic Interlayer: 0.060 inch thick, minimum.
   3. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.

2.04 SEALED INSULATING GLASS UNITS

A. Sealed Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Edge Spacers: Aluminum, bent and soldered corners.
   3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
   4. Purge interpane space with dry hermetic air.

2.05 GLAZING COMPOUNDS

A. Glazing Putty : Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

B. Butyl Sealant : Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; black color; non-skinning.

C. Silicone Sealant : Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected.

2.06 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; size as recommended by manufacturer inch black color.
   1. Manufacturers:
      a. Pecora Corporation: www.pecora.com.

b. Tremco Global Sealants: www.tremcosealants.com.
c. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; black in color.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Prime surfaces scheduled to receive sealant.

B. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

C. Install sealant in accordance with manufacturer's instructions.

3.03 GLAZING METHODS

3.04 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.06 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.07 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 08 8300
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in University of South Carolina's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for glazing installation methods.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS) "Mirrors Handle with Extreme Care: Tips For the Professional on the Care and Handling of Mirrors."

1.04 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mirrors:
   1. Arch Aluminum & Glass Co., Inc: www.arch.amarlite.com.
   2. Binswanger Mirror/ACI Distribution: www.binswangerglass.com.
   3. Lenoir Mirror Co: www.lenoirmirror.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Mirror Glass - General: Select materials and/or provide supports as required to limit mirrored glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

B. Mirror Glass (Type T-9): Clear float type with copper and silver coating, organic overcoating, arrised edges, 1/4 inch thick minimum.
   1. Sizes noted on Drawings.

2.03 GLAZING ACCESSORIES

A. Mirror Attachment Accessories: Stainless Steel Standoffs, refer to drawings.

B. Mirror Adhesive:
   1. Chemically compatible with mirror coating and wall substrate.
   2. 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).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive mirrors.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

C. Perform installation in accordance with ASTM C1193 for solvent release sealants. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install mirrors in accordance with GANA recommendations.

B. Set mirrors plumb and level, free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Frameless Mirrors: Set mirrors with clips. Anchor rigidly to wall construction.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Cementitious backing board.

F. Gypsum wallboard.

G. Joint treatment and accessories.

H. Grid suspension systems for ceilings

I. Reveals and control joints.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
   1. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For all stud framing products that do not comply with ASTM C645 or C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

E. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches in size, illustrating finish color and texture.

F. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

G.

H. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
   2. Documentation of Credit MR 5: Submit applicable LEED Submittal Form for each different product or component which has been extracted, recovered, or manufactured within 500 miles of the project site.
   3. For gypsum wallboard, submit documentation of recycled content and location of manufacture.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Phillips Manufacturing Company; Product _____: www.phillipsmfg.com.
   3. Marino/Ware .
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C shaped.

C. Exterior Non-Loadbearing Studs and Furring for Application of Gypsum Board: As specified in Section 09 2216.

D. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.

E. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
   4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. USG Corporation: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.

C. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including walls in shower areas..
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
      a. Thickness: 1/2 inch.
      b. Products:
         1) Custom Building Products; Wonderboard.

2) National Gypsum Company; PermaBase Brand Cement Board.
3) National Gypsum Company; PermaBase Flex Brand Cement Board.
4) USG Corporation; Durock Brand Cement Board.
5) Substitutions: See Section 01 6000 - Product Requirements.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Total recycled Content: shall have a minimum total recycled content of 955.
3. Type: Regular, in locations indicated.
4. Regular Board Thickness: 5/8 inch.
5. Edges: Tapered.

E. Ceiling Board: Special sag-resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 5/8 inch.
3. Total Recycled Content: shall have a minimum total recycled content of 95%.
4. Edges: Tapered.

2.04 SUSPENSION SYSTEMS

A. Grid Suspension Systems for ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock..
1. Products: subject to compliance with requirements, provide one of the following;
a. Basis of Design: Armstrong World Industries: Drywall Grid Systems
b. USG Corporation: www.usg.com.
c. Chicago Metallic Corporation; 600 Series Drywall Furring Systems.
d. Substitutions: See Section 01 6000 - Product requirements.

B. Accessories:
1. Edge trim: Factory finished extruded aluminum edge trim, height as shown on the drawings;
2. Color: white
3. Axiom "Classic Trim" or equal.

2.05 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness to fill stud widths.

B. Acoustic Sealant: As specified in Section 07 9005.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless otherwise indicated.
1. Types: As detailed or required for finished appearance.

D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
1. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Ready-mixed vinyl-based joint compound.

E. Aluminum trim:
1. Reveals and expansion joints ASTM B221, Alloy 6063-T5
2. Basis of Design:
a. Reveals: Pittcon SWR-050-050
b. Control Joints: Pittcon SWR-CJ -050-050
3. Finish: Aluminum. Reveal and Control Joint surfaces are to be exposed no paint.

4. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray applications, designed to take the palce of skim coating and separate paint primer in achieving Level 5 finish.

G. Screws for attachment to steel members from 0.033 tp 0.112 inch n thickness: ASTM C 954; steel drill screws for application of gypsum board to non load bearing or load bearing steel studs.

H. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Studs: Space studs as permitted by standard.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
   1. Wall mounted cabinets.
   2. Plumbing fixtures.
   3. Toilet partitions.
   4. Toilet accessories.
   5. Wall mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

F. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.06 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TOLERANCES

END OF SECTION

SECTION 09 2400
PORTLAND CEMENT PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement plaster for installation over masonry.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data on plaster materials, characteristics and limitations of products specified.

C. LEED Submittal: Documentation of recycled content and location of manufacture.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.04 FIELD CONDITIONS

A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.

B. Maintain minimum ambient temperature of 50 degrees F during installation of plaster and until cured.

PART 2 PRODUCTS

2.01 PLASTER MATERIALS

A. Portland Cement, Aggregates, and Other Materials: In accordance with ASTM C 926.

B. Premixed One-Coat Stucco: Mixture of Type I Portland cement, complying with ASTM C150/C150M, hydrated lime complying with ASTM C207, fibers and other approved ingredients, install in accordance with ASTM C926.
   1. Products:
      a. The QUIKRETE Companies; QUIKRETE® One Coat Fiberglass Reinforced Stucco: www.quikrete.com.
      b. Magna Wall, an Oldcastle brand; Magna Wall Fiber Reinforced One Coat Stucco: www.magnawall.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

C. Portland Cement: ASTM C150, Type I.
   1. For finish coat: White color.

D. Masonry Cement: ASTM C91 Type N.

E. Lime: ASTM C 206, Type S.

F. Aggregate: Natural sand, within the following sieve sizes and percentage retained limits:

G. Water: Clean, fresh, potable and free of mineral or organic matter that could adversely affect plaster.

2.02 PLASTER MIXES

A. Over Solid Bases: Three-coat application, mixed and proportioned in accordance with ASTM C926.

B. Base Coat over masonry consisting of Scratch and Brown Coats:
   1. One part portland cement.
   2. Minimum 3/4 and maximum 1-1/2 part hydrated lime.
   3. Minimum 2-1/2 and maximum 4 parts aggregate, per sum of cementitious materials.
   4. Reinforcement add per manufacturer's instructions.

C. Finish Coat:
   1. One part Portland cement.
   2. Color: As selected by Architect.

D. Mix only as much plaster as can be used prior to initial set.

E. Mix materials dry, to uniform color and consistency, before adding water.

F. Protect mixtures from freezing, frost, contamination, and excessive evaporation.

G. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify the suitability of existing conditions before starting work.

B. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

C. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.02 PLASTERING

A. Apply plaster in accordance with ASTM C926.

B. Three-Coat Application Over Metal Lath:
   1. Apply scratch coat to a nominal thickness of 3/8 inch.
   2. Apply brown coat to a nominal thickness of 3/8 inch.
   3. Apply finish coat to a nominal thickness of 1/8 inch.

C. Moist cure base coats.

D. Apply second coat immediately following initial set of first coat.

E. After curing, dampen previous coat prior to applying finish coat.

F. Finish Texture: Float to a consistent and smooth finish.

G. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.

H. Moist cure finish coat for minimum period of 48 hours.

3.03 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Tile for shower receptors.

D. Cementitious backer board as tile substrate.

E. Stone thresholds.

F. Ceramic accessories.

G. Ceramic trim.

H. Non-ceramic trim.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

F. LEED Submittal:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
2. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
3. Product Data for Credit EQ 4.3: For adhesives and grouts, documentation including printed statement of VOC content.

1.04 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.07 EXTRA MATERIALS:

A. Refer to Division 01 Section "Product Requirements" for additional provisions.

B. Provide 2% of each size, color, and surface finish tile specied, but not less than 2 full boxes.

PART 2 PRODUCTS

2.01

A. TILE
   1. Manufacturers: All products by the same manufacturer.
      a. American Olean Corporation: www.americanolean.com.
      b. Dal-Tile Corporation: www.daltile.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   2. Ceramic Mosaic Tile : ANSI A137.1
   3. Glazed Wall Tile : ANSI A137.1

B. TRIM AND ACCESSORIES
   1. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
   2. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
      a. Manufacturer: Same as for tile.
   3. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   4. Thresholds: Marble, white or gray, honed finish; 2 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.

C. SETTING MATERIALS
   1. Provide setting materials made by the same manufacturer as grout.
   2. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

D. GROUTS

E. THICK-BED MATERIALS

F. THIN-SET ACCESSORY MATERIALS
   1. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
      a. Type: Mortar-bonded sheet.
      b. Material: Chlorinated polyethylene sheet membrane with polyester fabric laminated to both sides, 30 mils, thick, minimum.
      c. Products:
   2. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
      a. Type: Fluid-applied.
      b. Material: SBS rubber.
      c. Thickness: 25 mils, minimum, dry film thickness.
      d. Products:
         1) AVM Industries, Inc; System 750 with polyester fabric reinforcing at edges, corners, joints, and cracks: www.avmindustries.com.
         2) LATICRETE International, Inc; LATICRETE Hydro Ban: www.laticrete.com.
         3) Merkrete, by Parex USA, Inc.; Merkrete Hydro Guard 2000: www.merkrete.com.
         4) Substitutions: See Section 01 6000 - Product Requirements.
   3. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:

a. Sound Reduction: Comply with ANSI A118.13, bonded membrane.
b. Crack Isolation: Comply with ANSI A118.12.
c. Water Resistance: Comply with ANSI A118.10, bonded waterproofing.
d. Uncoupling Function: Allow for separation between membrane and the mortar adhering tile to the membrane when subjected to excessive substrate movement.
e. Suitable for installation over green concrete.
f. Suitable for installation over wood-based substrates.
g. Type: Fluid-applied.
h. Do Not Use: Gypsum or cementitious based self-leveling underlayment.

4. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints. Use standard grout unless otherwise indicated.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.

B. Mortar Bed Thickness: 5/8 inch, unless otherwise indicated.

3.06 INSTALLATION - SHOWERS WALLS

A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. Grout with standard grout as specified above.

C. Seal joints between tile work and other work with sealant Type ____ specified in Section 07 9005.

3.07 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

3.08 CLEANING

A. Clean tile and grout surfaces.

3.09 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Materials: Furnish the following for University of South Carolina's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 2 percent of total installed.

G. LEED Submittal: .Documentation of recycled content and location of manufacture.
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content

1.04 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 EXTRA MATERIALS

A. Refer to Division 01 Section "Product Requirements" for additional provisions.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:

B. Basis of Design: Rockfon, LLC / Chicago Metallic www.rockfon.com
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Hunter Douglas Contract: www.hunterdouglascontract.com.
      a. USG: www.usg.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustical Units - General: ASTM E1264, Type XX, Pattern G

D. Acoustical Panels Type ACT-1 Rockfon Artic: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. Size: 24 x 24 inches.
   2. Thickness: 5/8 inches.
   3. Light Reflectance: 85 percent, determined as specified in ASTM E1264.
   4. NRC Range: .75, determined as specified in ASTM E1264.
   5. Ceiling Attenuation Class (CAC): 23, determined as specified in ASTM E1264.
   6. Edge: Tegular.
   7. Surface Color: White.
   8. Surface Pattern: Perforated.
   9. Suspension System: Exposed grid.

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Rockfon, LLC / Chicago Metallic www.rockfon.com; 260 /280 (Hook) fire rated 15/16 inch Aluminum Cap.
   2. Acoustic Ceiling Products, Inc.: www.acpideas.com.
   3. Hunter Douglas Contract: www.hunterdouglascontract.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required in accordance with Seimic Design Category C

C. Exposed Steel Suspension System: Chicago Metallic Double Web Intermediate duty rated ceiling suspension system as manufactured by Rockfon
   1. Profile: Aluminum capped tees, 15/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White painted.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 SCHEDULE

A. Refer to the drawings

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically so indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products, including VOC content.
   1. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

D. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.

E. LEED Report: 1. VOC content of all interior opaque coatings actually used.
2. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content/

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

H. Maintenance Materials: Furnish the following for University of South Carolina's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon of each color; store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Base Manufacturer: Sherwin Williams - ProGreen 200.
2. Duron, Inc: www.duron.com.
3. Glidden Professional: www.gliddenprofessional.com.
4. Benjamin Moore & Co: www.benjaminmoore.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each coating material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
   1) Opaque, Flat: 50 g/L, maximum.
   2) Opaque, Nonflat: 150 g/L, maximum.
   3) Opaque, High Gloss: 250 g/L, maximum.
   4) Varnishes: 350 g/L, maximum.
c. USGBC LEED Rating System, edition as stated in Section 01 3515; for interior wall and ceiling finish (all coats), anti-corrosive paints on interior ferrous metal, clear wood stains and finishes, sanding sealers, other sealers, shellac, and floor coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Chemical Content: The following compounds are prohibited:
1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Colors: As indicated on drawings
1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint EC-OP - Exterior surfaces indicated to be painted, unless otherwise indicated: Including hollow metal doors and frames..
1. Preparation as specified by manufacturer.
2. Two top coats and one coat primer recommended by manufacturer.

B. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.

C. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.

D. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
1. One coat galvanize primer.

2.04 PAINT SYSTEMS - INTERIOR

A. Interior surfaces indicated to be painted, unless otherwise indicated: Including gypsum board, uncoated steel, shop primed steel, and galvanized steel.
1. Two top coats and one coat primer.
2. Primer(s): As recommended by manufacturer of top coats.

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals, wood, and _____:
1. Two top coats and one coat primer.

C. Medium Duty Vertical/Overhead: Including gypsum board, uncoated steel, shop primed steel, and galvanized steel.
1. Two top coats and one coat primer.
2. Primer(s): As recommended by manufacturer of top coats.

D. Galvanized Metals, Alkyd, 3 Coat:
1. One coat galvanize primer.

E. Gypsum Board, Alkyd, 3 Coat:

1. One coat of alkyd primer sealer.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

A. Gypsum Board: Finish all surfaces exposed to view, except _____.
   1. Interior Ceilings and Bulkheads, flat.
   2. Interior Walls, semi-gloss.

B. Steel Doors and Frames: Finish all surfaces exposed to view, gloss.

C. Steel Fabrications: Finish all surfaces exposed to view.
   1. Exterior: gloss.
   2. Interior: gloss.

D. Galvanized Steel: Finish all surfaces exposed to view.
   1. Exterior:
   2. Interior:

E. Shop-Primed Metal Items: Finish all surfaces exposed to view.
   1. Finish the following items:
      a. Exposed surfaces of lintels.
      b. Elevator pit ladders.
      c. Exposed surfaces of steel stairs and railings.

END OF SECTION

SECTION 10 1101
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards.See drawings for locations.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit two samples 2 by 2 inch in size illustrating materials and finish, color and texture of markerboard and trim.

E. Test Reports: Show conformance to specified surface burning characteristics requirements.

F. Manufacturer's printed installation instructions.

G. Maintenance Data: Include data on regular cleaning, stain removal .

H. LEED Submittal:
   1. Product Data for Credit EQ 4.4: For composite wood products, documentation indicating that the product contains no urea formaldehyde.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. MooreCo, Inc: www.moorecoinc.com.
   2. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
   3. Polyvision Corporation (Nelson Adams): www.polyvision.com.
   4. Marsh Industries, Inc.; Visual Products Group.
   5. Platinum Visual Systems; a division of ABC School Equipment, Inc.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Whiteboards (WB-1): Porcelain enamel on steel, laminated to core.
   1. Color: White.
   2. Metal Face Sheet Thickness: 0.024 inch (24 gage).
   3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Size: See drawings for sizes
   6. Length: As indicated on drawings.
   7. Frame: Extruded aluminum, with concealed fasteners.
   8. Frame Finish: Anodized, natural.
   9. Accessories: Provide marker tray.
   10. Provide custom permanent layout of the soccer field on whiteboards. See drawings

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424, Type I, Commercial Steel, with fired-on vitreous finish.

B. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

C. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

D. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

B. Marker Tray: Aluminum, manufacturer's standard profile one piece full length of chalkboard, molded ends; concealed fasteners, same finish as frame.

C. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. See drawings for mounting heights and locations.

C. Secure units level and plumb.

D. Butt Joints: Install with tight hairline joints.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

SECTION 10 2113.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 ADMINISTRATIVE REQUIREMENTS

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, 3 x 3 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Ampco Products, Inc: www.ampco.com.
   2. Metpar Corp: www.metpar.com.
   3. Partition Systems International of South Carolina: www.psisc.com.
   4. Scranton Products (Santana/Comtec/Capital); Product ____: www.scrantonproducts.com.
   5. Substitutions: Section 01 6000 - Product Requirements.

2.02 SOLID PLASTIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), floor-mounted unbraced.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 24 inch.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 55 inch.
   5. Logo: Doors with Block C logo, see drawings.

C. Panels:
   1. Thickness: 1 inch (25 mm).
   2. Height: 55 inch.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 1 inch (25 mm).
   2. Width: As required to fit space; minimum 3 inches (76 mm).

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets .

2.03 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 in high, concealing floor fastenings.

B. Pilaster Brackets: Polished stainless steel.

C. Wall Brackets: Continuous type, polished stainless steel.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

E. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2800
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms and janitors closets.

B. Grab bars.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products listed are made by Bobrick Washroom Equipment; www.bobrick.com. Selected accessories by Gamco USA where noted in schedule below.

B. Other Acceptable Manufacturers:
   1. A & J Washroom Accessories Inc: www.ajwashroom.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269, Type 304 or 316.

D. Mirror Glass: Float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

E. Adhesive: Two component epoxy type, waterproof.

F. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

2.04 TOILET ROOM ACCESSORIES

A. Refer to schedule at end of this Section and Drawings.

B. Grab Bars: Stainless steel, nonslip grasping surface finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

3.04 SCHEDULE

A. Refer to drawings for accessory locations.

1. T-1: Paper Towel Disp./Waste Receptacle B-3944 (Contractor Furnished/ Contractor Installed)
2. T-2: Soap Dispenser.....(Owner Furnished / Contractor Installed.)
3. T-3: Toilet Tissue Dispenser.....(Owner Furnished / Contractor Installed.)
4. T-4: Tampon Disposal B-254.....(Contractor Furnished/ Contractor Installed)
5. Tampon / Napkin Dispenser B-3500 25 (Contractor Furnihed Furnished/ Contractor installed)
6. T-6: 42" Grab Bar B-6806x42 .....(Contractor furnished/ Contractor Installed)
7. T-7: 36" Grab Bar B-6806x36 .....(Contractor furnished/ Contractor Installed)
8. T-8: Chrome Framed Mirror 24" x 48" B-165x2448..... (Contractor furnished/ Contractor Installed)
9. T-9: Toilet Seat Dispenser .....(Owner Furnished / Contractor Installed.)
10. T-10: 18" Grab Bar B6806 x18 .....(Contractor furnished/ Contractor Installed)
11. T-11: Folding Shower Seat B-5191.....(Contractor furnished/ Contractor Installed)
12. T-12: Heavy Duty Clothes Hook/exposed mtd.B-233.... (Contractor furnished/ Contractor Installed)
13. T-13: Janitorial Rack B-239 .....(Contractor furnished/ Contractor Installed)

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions.

C. Product Data: Provide extinguisher operational features.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.03 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. JL Industries, Inc.: www.jlindustries.com .
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Potter-Roemer: www.potterroemer.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Basis of Design: Larsen's Manufacturing Co: "Architectural Series" cabinets; www.larsensmfg.com.
   2. JL Industries, Inc: www.jlindustries.com.
   3. Potter-Roemer: www.potterroemer.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type Fire Extinguishers: Cast steel tank, with pressure gage.
   1. Class: A.
   2. Size: 10 pound.
   3. Finish: Baked enamel, color as selected.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed and recessed cabinets as scheduled.
   1. Sized to accommodate accessories.
   2. Trim: Returned to wall surface, with minimum 2 1/2 inch projection, 1 inch wide face.
   3. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

D. Door Glazing: Plastic, clear, 1/8 inch thick acrylic. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.

H. Finish of Cabinet Interior: White enamel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, install at a height acceptable to authorities having jurisdiction.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

3.03 SCHEDULES

A. Location: Refer to Plans.

B. Cabinets:
   1. FEC - Semi-recessed; Model 2409-6R with MP-10 extinguisher.

END OF SECTION

SECTION 10 7113.43

FIXED SUN SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular, shop fabricated, extruded aluminum sun shades to be mounted on structure provided by others.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing all profiles, sections of all components, finishes, fastening details, and manufacturer's technical and descriptive data. Include field dimensions of openings and elevations on shop drawings.

C. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

D. Samples: 10 inches by 10 inches minimum illustrating design, workmanship and finish color.

E. Specimen Warranty: Furnish a copy of manufacturer's standard warranty.

F. Installer Qualification Statement.

G. LEED Submittals:
   1. Product Data for Credit MR 4.1 and Credit MR 4.2: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
   2. Report recycled aluminum content.

1.03 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with no less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section.
   1. With minimum five years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sun Shades: Correct defective work within a one year period after date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixed Sun Screens:
   1. Same manufacturer as storefront and windows to which sun screens are to be attached.
   2. Architectural Grilles & Sunshades, Inc.: www.agsshade.com.
   3. YKK AP America Inc: www.ykkap.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUN SHADES

A. Sun Shades: Shop fabricated, shop finished, extruded aluminum outriggers, louvers, and fascia, free of defects impairing strength, durability or appearance.
   1. Configuration: As indicated on drawings.
   2. Louver Type: Bar.
   3. Sun Shades Angle: 45 degrees from horizontal.
   4. Outrigger Shape: Straight.
   5. Design Criteria: Design and fabricate to resist the following loads without failure, damage, or permanent deflection:
      a. Wind: See Structural Drawings Sheet S1.0
      b. Snow: See Structural Drawings Sheet S1.0
      c. Live: See Structural Drawings Sheet S1.0
      d. Thermal Movement: Plus/minus 1/8 inch, maximum.
   6. Sizes: As indicated on drawings.
   7. Finish Color: Match storefront system framing.
   8. Provide a complete system ready for erection at project site.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B209 or B 221.

B. Aluminum Coated Steel Sheet: ASTM A792/A792M.

C. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.

D. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that dimensions of supporting structure are within plus/minus 1/8 inch of dimensions shown on shop drawings.

C. Verify that all adjacent painting, roofing, masonry work, and other work that might damage sun shades finish has been completed prior to installation of sun shades.

D. Do not install until after all adjacent painting, roofing and masonry have been completed.

E. Do not proceed with installation until all conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Set units level, plumb, with uniform joints, and aligned with building elements.

C. Separate dissimilar metals using concealed bituminous paint or non-absorbent gasket.

D. Anchor units to structure as indicated on the drawings.

E. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

3.03 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch.

3.04 CLEANING

A. Clean exterior surfaces units of dust and debris; follow manufacturer's cleaning instructions for the finish used.

END OF SECTION

SECTION 11 5213
PROJECTION SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Front projection screen assemblies.

B. Concealed ceiling mounted projector mount.

C. Wall mounted television mount.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Wiring diagrams for motor operators and actuators, and controls and switches.

C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.

D. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in University of South Carolina's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Experienced in manufacturing products specified in this section.

B. Installer Qualifications: Experienced in installation of the work of this section.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver projection screens to project site in manufacturer's original unopened packaging. Inspect for damage and size before accepting delivery.

B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F. Stack according to manufacturer's recommendations.

C. Acclimate screens to building temperatures for 24 hours prior to installation, or in accordance with manufacturer's recommendations.

1.05 FIELD CONDITIONS

A. Maintain interior of building between 60 degrees F and 75 degrees F during and after installation of projection screens.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5 year manufacturer warranty for projection screen assembly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Projection Screens:
   1. Basis of Design: Da-Lite Screen Company: www.da-lite.com.
   2. Bretford: www.bretford.com.
   3. Draper, Inc: www.draperinc.com.
   4. Stewart Filmscreen Corporation: www.stewartfilmscreen.com.

B. Television and Projector Mounts:
   1. Basis of Design: Chief Manufacturing; www.chiefmfg.com

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRONT PROJECTION SCREENS

A. Front Projection Screens: Factory assembled unless otherwise indicated.
   1. Film Room #126: Motorized, matte light diffusing fabric screen, , ceiling recessed.
      a. Screen Dimensions: 96 inches by 116 inches.
      b. Acceptable Product: "Advantage Electrol".

B. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.
   1. Material: Matte white vinyl on fiberglass backing, with nominal gain of 1.0 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
   2. Seams: No seams permitted in fabric up to 96 inches high by 54 inches wide.

C. Masking Borders: Black, four sides.

D. Extra Drops: Black; as required for ceiling height.

E. Concealed-in-Ceiling Screen Cases: Steel; integral roller brackets.
   1. Door Slat: Self trim; self-closing and -opening.
   2. Case Finish: Baked enamel.
   3. Case Color: Black.
   4. End Caps: Steel; finished to match case.

F. Electrically-Operated Screens:
   1. Roller: 2 inch aluminum, with locking device.
   2. Vertical Tensioning: Screen fabric weighted at bottom with aluminum bar with plastic end caps.

G. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

2.03 ELECTRICAL COMPONENTS

A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.

B. Motors: Direct drive, 110 V, 60 Hz.
   1. Screen Motor: Mounted inside roller; three wire with ground; quick reverse type; equipped with thermal overload cut-off.
      a. Electrical Characteristics: 1.2 amps.
      b. Motor mounted on sound absorber.
   2. Door and Adjustable Masking Motor: Mounted inside roller; three wire with ground; quick reverse type; equipped with thermal overload cut-off.
      a. Electrical Characteristics: 1.2 amps.

C. Controls: 3 position control switch with plate flush mounted.
   1. Provide 2 control stations to screen, with internal override to prevent more than one signal reaching the screen.

2.04 TELEVISION MOUNT

A. Flat Panel Pre-wire In-wall box: Chief PAC516.

B. Television Mount: Chief PSMT2015.

2.05 PROJECTOR MOUNT

A. Electrically operated projector mount.
   1. Chief "Smart-Lift" SL236FD.
   2. Voltage: 120VAC
   3. Current Draw: 0.75 amps continuous.

4. Downward Travel: 36 inches max.
5. Roll/Pitch/Yaw Adjustments: +/- 2 degrees, +/- 15 degrees, +/-10 degrees.

B. Operation: Infrared Remote. Provide Remote Control "IR10".

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that openings for recessed screens are correctly sized.

D. Verify type and location of electrical connections.

E. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.02 PREPARATION

A. Coordinate screen installation with installation of projection systems.

B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Install plumb and level.

E. Install electrically operated components ready for connection to power and control systems by others.

F. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

G. Test electrical components for proper working condition. Adjust as needed.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 2113
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit two samples, 6 inch long illustrating slat materials and finish, color, cord type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Materials: Furnish the following for University of South Carolina's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:
   1. Hunter Douglas: www.hunterdouglas.com.
   2. Levolor Contract: www.levolorcontract.com.
   3. Graber, division of Springs Window Fashions: www.graberblinds.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BLINDS AND BLIND COMPONENTS

A. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand; complying with WCMA A100.1.

B. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
   1. Width: 1/2 inch.
   2. Thickness: 0.008 inch.
   3. Color: As selected.

C. Slat Support: Woven polypropylene cord, ladder configuration.

D. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats

E. Bottom Rail: Pre-finished, formed steel with top side shaped to match slat curvature; with end caps. Color: Same as headrail.

F. Lift Cord: Braided nylon; continuous loop.

G. Control Wand: Extruded hollow plastic; hexagonal shape.

H. Headrail Attachment: Wall brackets.

I. Accessory Hardware: Type recommended by blind manufacturer.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/8 inch.

C. Fabricate blinds to cover window frames completely.

D. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/4 inch between blinds, located at window mullion centers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.03 INSTALLATION TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

3.06 SCHEDULE

A. All offices with windows or door sidelites shall receive horizontal louver blinds.

B. All work rooms and storage rooms with door sidelites or windows. shall receive horizontal louver blinds.

C. Rooms that are scheduled to recieve roller shades specified in Division 12 section "Roller Window Shades" shall not receive horizontal louver blindes.

END OF SECTION

SECTION 12 2413
ROLLER WINDOW SHADES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Roller shades and motorized shade operators.See plans for location.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, wiring diagrams, and relationship to adjoining Work.
   1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Coordination Drawings: Drawn to scale and coordinating penetrations and ceiling-mounted items.

D. First paragraph below assumes manufacturer's standard-size Samples are acceptable. Revise to suit Project.

E. Samples: For each exposed finish and for each color and texture required.

F. Window Treatment Schedule: Use same designations indicated on Drawings.

G. Maintenance data.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701 by a testing agency acceptable to authorities having jurisdiction.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with WCMA A 100.1.

PART 2 - PRODUCTS

2.01 ROLLER SHADES

A. Products: Subject to compliance with requirements, provide products by one of the following:
   1. Basis of Design: Lutron Shading Solutions by VIMCO."Sivoia; QED 100"
   2. MechoShade Systems, Inc.
   3. Draper, Inc.

B. Shade Material: .
   1. Composition: Fiberglass and Vinyl
   2. Width: 14'-0" feet (See Submittals 1.02, paragraph B (1)
   3. Colors: Basketweave with dual sided with 1% openness.Color to be selected from the standard chart.

C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets.

D. Direction of Roll: Regular, from back of roller.

E. Mounting Brackets: Fascia end caps, fabricated from steel finished to match fascia or headbox.

F. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; removable design for access.

G. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.

H. Bottom Bar: Steel or extruded aluminum, with metal capped ends. Provide exposed-to-view, external-type.

I. Mounting: Ceiling.

J. Shade Operation: Quiet Motorized operator.

2.02 ROLLER SHADE FABRICATION

A. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
   2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

B. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting headbox, roller, and operating hardware and for hardware position and shade mounting method indicated.

C. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

2.03 MOTORIZED ROLLER SHADE OPERATORS

A. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.

B. Comply with NFPA 70.

C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit 120V.

D. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.
   1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
   2. Motor Characteristics: Single phase, 120V, 60 Hz.
   3. Motor Mounting: Within manufacturer's standard roller enclosure.

E. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure flush mounted. Rocker-style, individual/group-control wall switch Microprocessor.

F. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.

PART 3 - EXECUTION

3.01 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

3.02 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Section 01 79 00 - Demonstration and Training.

END OF SECTION

SECTION 12 4813
ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum entrance floor grilles.

B. Recessed mat frames.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.

C. Shop Drawings: Indicate dimensions and details for recessed frame.
   1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

D. LEED Submittals: Report recycled content and source of product.

E. Maintenance Data: Include cleaning instructions, stain removal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Entrance Floor Grilles:
   1. Basis of Design: JL Industries; Product JL907.
   2. Kadee Industries; Product KDCP.
   3. CS Group; Product Pedigrid.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ENTRANCE FLOOR GRILLES AND GRATINGS

A. Entrance Floor Grilles: Recessed extruded aluminum grille assembly with nominal 1 inch wide tread strips running perpendicular to traffic flow, slots between treads, and perimeter frame forming sides of recess.
   1. Recess Depth: Nominal 1-3/4 inches.
   2. Tread Surfaces: Premimum Carpet.
   3. Colors: Color to be selected from Manufacturer's standards.
   4. Width Perpendicular to Traffic Flow: As shown on Drawings.
   5. Frame: Recessed clear anodized aluminum frame for embedding in concrete; minimal exposed trim; post installed concrete anchors. Set top of frame above finished concrete slab to align top edge of frame with top surface of ceramic tile finish.
   6. Frame Style: JL-L Cast in concrete.

B. Mounting: Top of non-resilient members level with adjacent floor.

C. Structural Capacity: Capable of supporting a rolling load of 1000 pounds without permanent deformation or noticeable deflection.

D. Vibration Resistant Fabrication: All members welded, riveted, or bolted; no snap or friction connections.

E. Carpet insets shall be replacable.

2.03 FABRICATION

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor opening for mats are ready to receive work.

3.02 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor recess.

3.03 INSTALLATION

A. Install frames to achieve flush plane with finished floor surface.

B. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

3.04 TOLERANCES

A. Maximum Gap Formed at Recessed Frame From Mat Size: 1/4 inch.

END OF SECTION

SECTION 21 00-00

FIRE SUPPRESSION

PART 1: GENERAL PROVISIONS

1.1 SCOPE:

a. This specification includes the furnishing of all labor, materials, equipment, and service necessary or incidental to the complete installation testing, adjusting and placing into service of the several systems of fire protection, all as shown on the drawings and as hereinafter specified. Drawings and specifications are considered as mutually explanatory criteria and all work called for by one and not the other shall be performed as though called for by both. In cases of conflicting information, the Architect/Engineer shall be notified at once in writing. Where incidental equipment or appurtenances as required, and are not listed as shown, same shall be furnished as required for a complete fire protection system.

b. Work included in this specification shall consist of, but is not necessarily limited to, the following items:

1. Arrange for, obtain and bear the cost of necessary permits, bonds and fees for the automatic sprinkler work.

2. Furnish and install sprinkler system to sprinkler the building. System to include all pipe, hangers, sprinkler heads, valves, controls, drains, and alarms.

3. Furnish and install Fire Department connections located where shown on the drawings.

4. Furnish and install all alarms, flow switches and alarm bells on the inside and outside of the building.

5. Do the testing of all piping work and necessary cleaning of the fire protection work.

6. Furnish the shop drawings and certificates of inspection.

7. Periodically remove from the job site all rubbish or debris resulting from the fire protection work.

8. Do all cutting and patching.

9. Miscellaneous items as hereinafter specified.

1.2 RELATED DOCUMENTS:

a. The following related document shall apply to and govern the work in this section of the specifications:

1. Section 23 0500 – Common Work Results for HVAC

1.3 QUALIFICATIONS OF CONTRACTORS:

a. The Contractor for the Fire Protection installation shall be a qualified Fire Protection Contractor, regularly engaged in the installation of automatic fire sprinkler systems.

1.4 WORK BY OTHERS:

a. Electrical Contractor to wire all water flow switches and tamper switches on valves to central alarm panel. He shall also wire alarm bells.

1.5 STANDARDS, CODES AND REGULATIONS:

a. The applicable current standards for the fire protection systems shall be the National Fire Protection Association (N.F.P.A.), N.F.P.A. – 13 (2010), International Building Code (2012), and all other applicable state codes and ordinances.

1.6 SUBMITTAL (SHOP) DRAWINGS AND DATA:

a. Before commencing any work or providing materials at the job site for this project, the Fire Protection Contractor shall submit to the Engineer, for his approval, eight copies of catalog cuts and descriptive matter regarding materials and equipment which he intends to furnish and install. Shop drawings and data shall be submitted specifically for, but not limited to, the following items:

1. Sprinkler heads, valves, pipe, pipe hangers and couplings, hose valves and accessories, and fire department connections.

b. The Fire Protection Contractor shall prepare calculations and shop drawings for automatic sprinkler work showing the arrangement of all automatic sprinkler piping and equipment, spacing of sprinkler heads, elevations of lines and details necessary for the conduct of work. The Contractor shall submit to the specifying engineer, for approval, four copies of his shop drawings and calculations.

c. The Engineer shall review the drawings and calculations and upon approval issue a certificate of compliance, which is to be submitted to the authority having jurisdiction along with the shop drawings for his/her approval.

c. The Fire Protection Contractor shall not proceed with the installation of the work until he has received the approval of the authority having jurisdiction.

d. The Engineer’s approval of shop drawings, catalog cuts, etc., shall not relieve the Fire Protection Contractor of the responsibility for any errors or omissions which may exist in the items submitted, nor shall it relieve him from responsibility for deviations for the contract drawings or specifications.

e. In the event additional clarifying details are required by inspection authorities, the details shall be prepared and approval of the same secured by the Fire Protection Contractor at his expense.

PART 2: PRODUCTS

2.1 GENERAL:

a. All materials and equipment furnished under this Section shall be new, approved by Underwriters' Laboratories, Inc. (UL), Factory Mutual (F/M), and American Water Works Association (AWWA) where applicable.

b. All pipes used on this project shall be manufactured in the United States and be in compliance with the dimensional and quality standards cited in these specifications.

2.2 AUTOMATIC SPRINKLER SYSTEMS:

a. Pipe shall be new, designed for 175 PSI working pressure, conforming to ASTM specifications, and have the manufacturer's name or brand, along with the applicable ASTM standard, marked on each length of pipe.

b. Pipe shall be steel, Schedule 40, black, and in accordance with specifications ASTM A53 or Schedule 10, black, and in accordance with specifications ASTM A135. Black and hot-dipped zinc-coated (galvanized) welded and seamless steel to be per standard ASTM A795.

c. Tubing shall be copper, Type L, suitable to withstand water working pressure not less than 175 PSI, and in accordance with specification ASTM B75 or ASTM B88.

2.3 FITTINGS:

a. Screwed fittings shall be cast iron, 125 pound Class, black, and in accordance with ANSI B16.4 or malleable iron, 150 pound Class, black, and in accordance with ANSI B16.3.

b. Flanged fittings shall be cast iron, short body, Class 125, black, and in accordance with ANSI B16.1. Gaskets shall be full face of 1/8" minimum thickness red sheet rubber. Flange bolts shall be hexagon head machine bolts with heavy semi-flushed hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B18.2.

c. Weld fittings shall be steel standard weight, black, and in accordance with ANSI B16.9, ANSI B16.25, ASTM A234, ANSI B16.5 or ANSI B16.11.

d. Fittings for copper piping shall be wrought copper and bronze solder joint pressure fittings in accordance with ANSI B16.22 and cast bronze solder joint pressure fittings in accordance with ANSI B16.18.

e. Grooved-End Fittings to be UL-listed ductile-iron casting with OLD matching steel-pipe OD. Grooved-End-Pipe Couplings to be UL 213 and AWWA C606, rigid pattern, gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 VALVES:

a. Outside screw and yoke (OS&Y) gate valves, shall be flanged, iron body, bronze mounted, 175 PSI working pressure, with handwheel turning counter-clockwise to open. Valve shall be tested and listed by UL and/or FM.

b. Check valve (ck.v.) shall be flanged, swing type, iron body, bronze seat ring and disc rings and 175 PSI pressure rating. Valve shall be tested and listed by UL and/or FM.

c. Check valve (ck.v) shall be butterfly wafer style, iron body, rubber seal, and 250 PSI pressure rating. Valve shall be tested and listed by UL and/or FM.

d. Fire department connection shall be 2-1/2" x 2-1/4" x 4" Siamese connection or 2-l/1" x 3" single connection, brass body, brass chain and plugs, and brass escutcheon lettered "AUTOMATIC SPRINKLER." Inlet threading shall be National Standard, same as municipal fire department. Fire department connection shall be tested and listed by UL and/or FM.

d. Valve for main riser drain shall be angle type or globe type, bronze body, screwed, 200 PSI pressure rating, 2" size, and a renewable composition soft disc.

e. Valve for auxiliary drain and inspector's test connection shall be globe type, bronze body, screwed, 200 PSI pressure rating, 1" size and a renewable composition soft disc.

2.5 ACCESSORIES:

a. Backflow preventer shall be reduced pressure type, flanged, 150 PSI working pressure, with OS&Y shut-off valves. The backflow preventer shall meet all requirements of AWWA Standard C506. The backflow preventer shall also be tested and listed by UL and/or FM. A factory trained representative shall supervise and inspect the installation of the backflow preventer. After the installation has been approved by the factory trained representative, he/she shall send a formal letter of approval to the Architect.

b. At each location where called for on plans, or where required by the authority having jurisdiction, provide an approved retard-type electric flow alarm switch. Provide alarm bells as required by governing code. Flow alarm switch shall have extra set of contacts for extension by others to central alarm panel.

1. Interior bell or horn shall be 12, 24 or 120 volt, AC or DC. Horn or bell shall be tested and listed by UL and/or FM.

2. Exterior bell or horn shall be weatherproof 12, 24 or 120 volt, AC or DC. Horn or bell shall be tested and listed by UL and/or FM.

3. Flow switch shall be vane type 12, 24 or 120 volt AC or DC. Flow switch shall be tested and listed by UL and/or FM.

4. OS&Y gate valve supervisory switch shall be 12, 24 or 120 volts, AC or DC. Supervisory switch shall be tested and listed by UL and/or FM.

c. Sprinkler heads shall be upright, pendent, concealed, vertical sidewall, horizontal sidewall, and/or dry pendent type as required, 1/2" and/or 17/32" orifice, 1/2" and/or 3/4" pipe thread, rated 165 degrees F., 212 degrees F., and/or 286 degrees F. Sprinklers in areas with suspended ceilings shall be chrome plated with escutcheons. Sprinklers shall be tested and listed by UL and/or FM. Furnish steel enameled box housing quantity of sprinklers and wrenches compliant with NFPA 13 6.2.9.

PART 3: EXECUTION

3.1 AUTOMATIC SPRINKLER SYSTEMS:

a. Schedule 40 black steel pipe shall be joined by screwed joints in accordance with specification ANSI B2.1, by welded joints in accordance with specifications ANSI B31.10, ANSI B31.1.0a and ANSI B31.1.0b, and by mechanical grooved couplings or push-on couplings, joined by a UL approved combination of couplings, gaskets and grooves. Grooves may be rolled or cut and they shall be dimensionally compatible with the couplings.

b. b. Schedule 10 black steel ASTM A135 sprinkler pipe shall be joined by grooved joints in accordance with specifications ANSI B31.1.0, ANSI couplings. Couplings to be of the rolled groove type. Grooves shall be dimensionally compatible with the coupling. Do not use cut grooves.

c. Copper tubing shall be joined by brazed joints except solder joints may be permitted for wet-pipe systems in light hazard occupancies where the temperature classification of the installed sprinklers is ordinary or intermediate. Solder joints may also be permitted for ordinary or intermediate. Solder joints

may also be permitted for wet-pipe systems in ordinary hazard -Group 1 occupancies where the piping is concealed. Brazing shall be done in accordance with specifications ANSI B31.1.0, ANSI B31.1.0a, and ANSI B31.1.0b. Brazing filler metal shall be classification BCUP-3 or BCUP-4 in accordance with AWS A5.8. Solder metal shall be 95-5 (tin-antimony - Grade 95 TA) in accordance with ASTM B32.

d. The interior surfaces of all piping and equipment shall be clean and free of all dirt, loose scale, rust, and other foreign material before installation.

e. Pipe ends shall be reamed to remove all burrs, and pipe sections shall be cleaned inside to remove all chips and foreign material prior to making up joints. Approved joint compound shall be applied to the threads of the pipe and not in the fitting when making up joints. Pipe shall not extend into the waterway of the fitting.

f. Sprinkler heads installed where they may be exposed or subjected to mechanical damage shall be furnished complete with head guards.

g. When welding pipe on job site, the fire hazard of the welding process shall be suitably safeguarded. All welding to be performed in compliance with the requirements of IFC Chapter 35

h. Pipe passing through building walls and floors above grade shall be provided with sleeves of standard weight galvanized steel pipe. The annular spaces between pipe and sleeves shall be packed tight with link seal hydrostatic pipe wall sleeve. Provide chrome plated escutcheon plates large enough to cover the pipe sleeve. Sleeves shall be sized as follows:

1"	2" ID sleeve
1-1/4" pipe	2" ID sleeve
1-1/2" pipe	2-1/2" ID sleeve
2" pipe	3" ID sleeve
2-1/2" pipe	4" ID sleeve
3" pipe	5" ID sleeve
4" pipe	6" ID sleeve
6" pipe	8" ID sleeve
8" pipe	10" ID sleeve

3.2 PIPE SUPPORTS:

a. All piping shall be supported by means of hangers tested and listed as approved by UL and/or FM. Sizing, spacing and installation shall be in accordance with National Fire Protection Association Standard No. 13 "Sprinkler Systems", except as otherwise shown on drawings or specified herein.

b. No cutting, drilling, welding or burning of any structural steel member shall be allowed. Power driven studs and welding studs shall not be allowed.

c. All bolts and threaded rods shall be used with double nut washer, or single nut, washer and lock washer wherever a single unsecured nut could work loose and allow either threaded rod or supported piping to drop.

d. Starting length, end length and alternate lengths of main piping with grooved joint couplings shall be provided with two supports.

3.3 TESTS AND INSPECTION:

a. The Fire Protection Contractor shall conduct and bear the costs of all necessary tests of the fire protection work, furnishing all labor power and equipment. All piping shall be tested with water, the tests witnessed by representatives of the Architect.

b. The fire protection piping shall be tested under a hydrostatic pressure of not less than 200 pounds PSIG, for a duration of not less than two (2) hours.

c. The piping subjected to the hydrostatic test shall be filled with water and thoroughly checked for the elimination of all air. The control valves of existing risers shall be closed during pressure testing of the new connection to the main. All joints shall be proven tight or acceptable by the test. Defective work or materials shall be corrected or replaced in an approved manner. If necessary, piping shall be dismantled and reassembled with the use of new pipe or fittings, as no caulking or makeshift method of temporary repair of defective work will be permitted. Tests shall be repeated until the particular line or system receives the approval of the representatives of the Architect.

d. Acceptance of the automatic sprinkler work shall be based upon the inspection and tests of the completed installation by representative of the local Fire Department , USC Fire Marshal and the Engineer.

3.4 WATER DAMAGE:

a. The Fire Protection Contractor shall be responsible for any damage to the work of others, to building and property/materials of others caused by leaks in automatic sprinkler equipment, unplugged or disconnected pipes or fittings, and shall pay for necessary replacement or repair of work or items so damaged during the installation and testing periods of the automatic sprinkler work.

3.5 HYDRAULIC CALCULATIONS:

a. The Fire Protection Contractor shall prepare hydraulic calculations for the design of the system and submit for approval to the Engineer as part of the shop drawings called for in these specifications.

3.6 IDENTIFICATION SIGNS AND CHARTS:

a. The drain, alarm test valves, etc., shall have standard identification signs, painted fire red with white lettering. The signs shall be attached to the valve in a conspicuous position.

Fire Sprinkler System Specification Sheet

(Per §40-10-250)

Project Data			
Project name: UNIVERSITY OF SOUTH CAROLINA - NEW SOCCER BUILDING			
Location in South Carolina:	Address (street # & street name): HOWARD ST. @ S. MARION ST COLUMBIA SC		State project: Yes
	City: COLUMBIA	County: RICHLAND	State project #: H27-6105-MJ-B

Water Supply Information (flow test data must be less than 1 year old per §40-10-250(A)(1))			
Date test conducted: 01 / 09 /2014	Static pressure (psi): 84	Residual pressure (psi): 45	Flow (gpm): 1245
Distances of test gauges relative to the base of the riser:	Horizontal (ft): 605	Vertical (elevation difference in ft): -2.5'	
Source of water supply:	**Municipal circulation**		Pipe Size (in.): n/a
Test data by/from:	Name: Jason Shaw	Title: Water Engineer	
	Organization: City of Columbia		Telephone #:803-545-3400
Fire pump:	No	Pump Capacity (gpm):N/A	Churn Pressure (psi): N/A
		Rated Pressure (psi):N/A	Pressure @ 150% flow (psi): N/A
On-site storage tank:	No	☐ New ☐ Existing	Tank capacity (gallons):

NFPA Hazard Classification
(attach continuation page when necessary)

Area #	Class or Code Reference	Description of Hazard Protected (commodity description, storage height, and arrangement as applicable.)
1	Light Hazard	Lockers, exercise, film, therapy, trainingrooms, lounge and offices
2	Ordinary Hazard I	Mechanical/Electrical Rooms, Storage

Design Parameters
(attach continuation page when necessary)

Area #	System Type	Density (gpm/ft²) / Area (ft²) or Other (reference code section)	Inside Hose (gpm)	Outside Hose (gpm)
1	WET PIPE	0.1/1500		100
2	WET PIPE	0.15/1500		250

Seismic Design Data: S_S= 0.55

Codes and Standards
(attach continuation page when necessary)

Applicable Codes, Standards & Editions (i.e. "2006 IBC", "2007 NFPA 13", etc.) **for the Scope of Work on the Sprinkler System**

Sprinkler System NFPA 13 (2010)

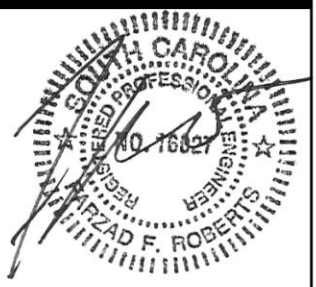
IBC (2012), IFC (2012)

Scope of work (such as sprinkler system A.G. from 1'-0" A.F.F., U.G. from tap to 5'-0" outside, etc.) and notes (attach continuation page when necessary):
Sprinkler system for entire project, starting from connection to site pipes 1'-0" above finished floor.

Specifier's Information

Name: Farzad F. Roberts	
Engineering services provided through a firm: ☐ Yes	
Firm name: JHS ARCHITECTURE	
Address: 1812 LINCOLN ST	
City: COLUMBIA	
State: SC Zip: 29201	
Phone #: 803-252-2400 Fax #: 803-252-1630	
E-mail: FROBERTS@JHS-ARCHITECTS.COM	

Certificate of Authorization



Professional Engineer's Seal

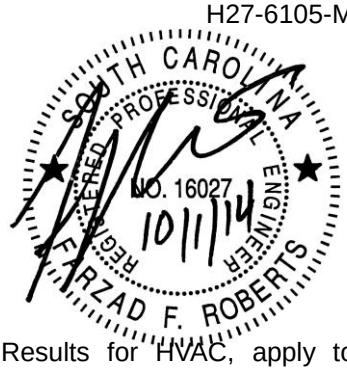
Revision No.: 0

Page 1 of 1

Signature: _____

Date: 10/01/14

End of Section



SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1: GENERAL

1.1 DESCRIPTION:

a. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all the work in this Section.

b. This section of specifications and related drawings describe requirements pertaining to basic materials and methods.

c. Please refer to coordination process requirements in Division 1.

1.2 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Manufacturer's cuts.

b. Certified capacity ratings.

c. Installation instructions.

d. Operating and Maintenance Instructions.

PART 2: PRODUCTS

2.1 PIPES:

a. All pipes used on this project shall be manufactured in the United States and be in compliance with the dimensional and quality standards cited in these specifications

2.2 PIPE SPECIALTIES:

a. Pipe specialty equipment shall be provided on all piping on all piping system as specified or as required by code.

b. Provide dielectric unions on the inlet and outlet connection to water heaters storage tanks and at all places where dissimilar metals join in piping and plumbing systems. Use dielectric unions as manufactured by Watts Regulator Inc., Zurn/Wilkins, Victaulic or equal.

c. Vacuum breaker shall be provided on each hose outlet. This includes hose bibbs, service sinks, wall hydrants, etc.

d. A system of pulsation absorbers shall be provided for all quick closing valves and where shown on the drawings. The system is to be selected in accordance with PDI Standard W-201. Absorbers shall be by JOSAM, ZURN, SMITH or approved equal.

e. Valves and Accessories:

1. Provide valves as indicated and required as scheduled below. Figure numbers are

provided to indicate type and quality. Insofar as possible, all valves shall be by a single manufacturer as specified or approved equal.

MANUFACTURER	GATES 125#	GLOBES 150#	CHECK 125#
NIBCO	T134	T235-Y	T413-B
CRANE	428-UB	-	37
STOCKHAM	B-105	B-22	B-319

f. SOLDER ENDS, SCREWED BONNET GATES, UNION BONNET GLOBES, (Globes with Teflon disc):

MANUFACTURER	GATES 125#	GLOBES 150#	CHECK 125#
NIBCO	S111	S235-Y	S413-B
CRANE	428-UB	-	1342
STOCKHAM	B-109	B-24	B-309

g. Hose end gate valves, 3/4 - 2" shall be JENKINS NO. 372, CRANE 451, POWELL 503 or approved equal.

h. Wall hydrants shall be cast brass non-freeze, heavy duty with polished chrome face, brass operating parts, adjustment locknut, renewable nylon seat, 3/4" standard hose outlet, locking cover.

2.3 HANGERS AND SUPPORTS:

a. All pipe hanger and supports shall be manufactured to comply with the latest edition of MSS-SP-58. Where applicable, design and manufacture of these products must also conform to ANSI/ASME Code for Pressure Piping, 831.1; UL203 Standard for Pipe Hanger Equipment and Fire Protection Service; Factory Mutual FM1551 Approval Standard for Pipe Hanger Components for Automatic Sprinkler Systems; Metal Framing Manufacturers Association, MFMA-2 and Local Building Codes.

b. All selection and installation of pipe supports shall conform to MSS-SP-69 and other specifications that may apply which are listed in this document.

c. Hangers, supports, anchors and restraints must be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment. Piping supports and equipment must be considered as a total system and appropriate balance calculations made to determine load forces at critical stress ponints.
Loading conditions to be considered may Include but are not limited to:

1. The total load of pipe, fittings, valves, insulation and any expected contents of the pipe.

2. Thermal expansion and contraction.

3. Stress from cycling of equipment or process.

4. Vibration transmitted to or from equipment or terminal connection.

5. Wind, snow or ice loading on outdoor piping.

6. Loading due to seismic forces if required by code or specification.

d. Static and dynamic forces at points of attachment must be considered to insure structural integrity of buildings or equipment. Hanger and supports must be selected to minimize the effect of piping system

loading on the structure.

e. MATERIAL:

1. Appropriate materials and protective coatings shall be used to prevent failure from environmental and galvanic corrosion.

2. Material that comes in contact with pipe shall be compatible with piping material so that neither has a deteriorating effect on the other.

1. Hangers shall adequately support the piping system. On horizon¬tal, hangers shall be located near or at changes in piping direction and con¬centrated loads. They shall provide vertical adjustment to maintain pitch required for proper drainage. They shall allow for expansion and contraction of the piping.

(a) Pips shall be supported in accordance with the requirements of the International Plumbing Code.

2. Devices for attaching pipe supports to building structure shall be provided as required and shall be as herein specified.

(a) Grinnell Type CB insert shall be provided for poured-in-place concrete construction. Drilled inserts approved equal to "Phillips" self-drilling inserts shall be provided in existing concrete construction and in precast and cast-in-place concrete construction where drilled inserts are approved by the Engineer. Other type inserts, if required, are specified in the section of this Division requiring such inserts.

(b) Grinnell Figure 86 malleable C - clamp with restraining clip shall be provided for attaching 2" and smaller piping to steel structure. MSS-SP-69 malleable beam clamp with extension piece shall be provided for attaching 2-1/2" and larger piping to steel structure.

3. Intermediate attachments shall be hanger rods of size herein before specified and with vibration control devices as specified in the separate section of the Division. Rods may be continuous threaded or threaded each end as required. No chain, wire, or perforated straphangers shall be used.

4. Pipe attachments and spring hangers shall be as specified in individual section of this Division of the specifications.

2.4 ESCUTCHEON PLATES:

a. Pipes entering finished or occupied areas shall be provided with polished chrome plated escutcheon plates, held in place with set screws. Escutcheon plates shall be Grinnell Figure 20 or approved equal.

PART 3: EXECUTION

3.1 GENERAL:

a. All products shall be installed as per the manufacturer's instructions.

3.2 CLEANING UP:

a. Cleaning up is the responsibility of the Contractor. During construction, the site shall be kept neat so as not to be a safety hazard. Upon completion of the work, all surplus construction materials and debris shall be removed from the property.

3.3 PIPE TEST:

a. All new soil, waste, drainage and vent piping shall be tested before fixtures are installed by capping or plugging the openings, and filling the entire system with water to a minimum height of 10 feet above grade or the highest fixture opening of the section being tested, and allowing it to stand thus filled for a period of four hours.

b. All water supply piping shall be tested before fixtures or faucets are connected by capping or plugging the opening and applying a hydrostatic test pressure of 150 psig.

c. Pipe found defective during tests shall be replaced at no additional cost to the Owner. Pipe joints found defective during tests shall be taken apart and remade.

d. The Contractor shall notify the Architect 72 hours before tests are to be made. Concealed work shall remain uncovered until specified tests are completed. All tests shall be conducted in the presence of the Architect or his representative. Repairs to defects disclosed by the test shall be made with new materials. Caulking of screwed joints, cracks or holes will not be permitted. Test shall be repeated until system is proven tight.

End of Section

SECTION 22 1100

FACILITY WATER DISTRIBUTION

PART 1: GENERAL

1.1 SCOPE:

a. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all the work in this Section.

b. Contractor shall furnish and install domestic water systems as shown on the plans complete in all respects.

c. Connect to water main and provide supply lines to all fixtures and equipment requiring water service.

d. See section 23-0700 for insulation requirements

1.2 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Manufacturer's cuts.

PART 2: PRODUCTS

2.1 QUALITY CONTROL:

a. All pipes used on this project shall be manufactured in the United States and be in compliance with the dimensional and quality standards cited in these specifications.

2.2 WATER PIPING AND FITTINGS:

a. Water Piping:

1. All domestic water piping shall be hard drawn copper tubing ASTM B 88 Type "L" above grade, Type "K" below grade. Fittings for copper tubing shall be ANSI B16.18 or B16.22 solder joint fittings. Ends of pipe shall be reamed, pipe and fittings cleaned. Use only 95-5 (95% tin and 5% antimony) solder with non-corrosive flux on 1-1/2" and smaller and on 2" and larger use Sil-Fos, or equal.

2. Underground fire and combined domestic-fire pipe shall be ductile iron, push-on or mechanical joint, thickness Class 50, 350 PSI pressure rating, in accordance with AWWA C151, tar coated outside, cement mortar lines inside in accordance with AWWA C104.

a. Push-on joints shall be in accordance with ANSI A21.11. Gasket material shall be neoprene.

b. Mechanical joints shall be in accordance with AWWA C111. Gasket material shall be neoprene. The standard bolts and nuts of the pipe manufacturer shall be used. These bolts and nuts shall be corrosion-resistant.

c. Flanged joints shall be in accordance with ASME B16.1. Gaskets shall be full face of 1/8 inch

minimum thickness red rubber. All flange bolts shall be hexagon head machine bolts with heavy cadmium plated hexagon nuts. A bituminous coating of coal tar or asphalt base shall be applied to flanges, bolts and nuts at the time of installation.

d. Fittings (for ductile iron pipe) shall be push-on or mechanical joint, 250 PSI pressure rating, in accordance with AWWA C110, tar coated outside, and cement mortar lined inside in accordance with AWWA C104.

e. Fittings in pits shall be flanged ductile iron, short body, 250 PSI pressure rating, in accordance with AWWA C110, tar coated outside, cement mortar lined inside in accordance with AWWA C104.

f. Tapping sleeve shall be mechanical joint, Class 125 outlet flange, 200 PSI pressure rating tapping sleeve, flanges, and bolts and nuts shall be coated with a bituminous coating of coal tar or asphalt base.

PART 3: EXECUTION

3.1 INSTALLATION (INSIDE):

a. Piping shall be installed so as to be free floating. 125 pound copper sweat pattern unions shall be provided in the piping as indicated on the drawings. Provide dielectric insulating unions where copper connects to ferrous piping. Use brass nipples or copper adapters at connections to fixtures.

b. Provide isolation valves for each individual riser and toilet group as required to service system.

c. Runouts:

1. Runouts to fixtures shall be grouted in place at the fixture stop to prevent pipe movement at this point. Use concrete mortar grout. Remove insulation from pipe before grouting.

2. Runouts to urinal and water closet flush valves in block and concrete walls shall have an 8" long piece of 1/2" copper, flattened and soldered to the runout and anchored in the wall. Runouts in stud walls shall have a piece of 1/2" copper flattened and soldered to the runout and fastened to studs with 1/4" bolts with nuts and flat washers (two bolts each end).

d. Unions:

1. Unions shall be installed at each piece of equipment.

3.2 PIPE LAYING (FIRE AND COMBINATION DOMESTIC/ FIRE WATER):

a. All pipe, valves and fittings shall be thoroughly inspected before use and defective or damaged items rejected. Each pipe, valve and fitting shall be cleaned before laying and open ends protected during laying to prevent the entrance of foreign materials. Open ends of work in progress shall be adequately covered by means of wooden plugs or other equally effective means at the end of each work period to prevent entrance of foreign materials as caused by storms, cave-ins, etc., during off-work hours.

b. Trenches shall be free of any standing water when pipe is laid.

c. All pipe lines shall be laid straight and in true alignment to the lines and grades established on the drawings. Pipe shall have not less than 4'6" cover, unless otherwise noted on the drawings.

d. Pipe passing under building grade beams shall have a 6" minimum clearance to prevent possible damage from building settlement.

e. Pipe passing through pit walls, building walls, and building floors below grade shall be provided with sleeves of standard weight galvanized steel pipe. The annular spaces between pipe and sleeves shall be sealed with link seal hydro-static pipe wall seal. Sleeves shall be sized as follows:

3" pipe - 6" ID sleeve
4" pipe - 8" ID sleeve
6" pipe - 10" ID sleeve
8" pipe - 12" ID sleeve
10" pipe - 14" ID sleeve

f. All temporary blocking of bricks, timbers, or other objects used by Contractor when laying pipe shall be removed and the voids filled with compacted bedding material prior to backfilling.

g. Bends, tees, plugs and fire hydrants installed underground shall be anchored by rodding or concrete thrust blocks. Rodding or concrete thrust block shall be in accordance with National Fire Protection Association Standard No. 24 "Outside Protection". A bituminous coating of coal tar or asphalt base shall be applied to pipe clamps, straps, rods, bolts, washers, nuts and couplings at time of installation.

h. Trenches shall not be backfilled until all inspections and tests, as specified herein, have been made and successfully concluded.

3.3 FLUSHING (COMBINATION DOMESTIC/ FIRE WATER):

a. Before permanently filling the site fire water system with water and before connections are made to the automatic sprinkler risers, all parts of the system shall be thoroughly flushed until water runs clear.

b. The flushing operation shall be continued for a sufficient time to ensure thorough cleaning.

c. The minimum rate of flow shall be not less than one of the following:

1. Hydraulically calculated water demand flow rate of the system, including any hose requirements

2. Flow necessary to provide a velocity of 10 ft/sec in accordance to the following:

PIPE SIZE	FLOW, GPM
4	390
6	880
8	1,560
10	2,440
12	3,520

3. Maximum flow rate available to the system under fire conditions.

3.4 HYDROSTATIC TESTING (COMBINATION DOMESTIC/ FIRE WATER):

a. All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested according to requirements of NFPA 24 section 10.10.2.2.

3.5 STERILIZATION OF WATER PIPING:

a. Sterilization of water piping shall be in accordance with AWWA Specification 0601. After the pressure tests have been made, the system shall be flushed with water. The chlorinating material shall be liquid chlorine-water mixture calcium hypochlorite, sodium hypochlorite, or chlorinated lime-water mixture. The solution shall have not less than 50 PPM available chlorine. The disinfecting solution shall be allowed to remain in the system for a minimum period of 24 hours. After disinfection, the system shall be flushed with clean water until residual chlorine content is not greater than .02 PPM. After the system is flushed, water samples shall be taken and tested at the Contractor's expense by an independent testing lab and reports shall be furnished to the engineer's for approval. If the water is found unsafe for human consumption, the disinfection procedure shall be repeated.

3.6 TESTING OF WATER PIPING:

a. All water supply piping shall be testing before fixtures or faucets are connected by capping or plugging the openings and applying a hydrostatic test pressure of 150 psig. Pressure shall hold constant (exception for temperature variation) for a period of 24 hours or as directed by the Engineer.

End of Section

SECTION 22 1310

FACILITY SANITARY SEWERAGE AND DRAIN PIPING

PART 1: GENERAL

1.1 SCOPE:

a. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all the work in this Section.

b. All fixtures and equipment specified as requiring waste shall be connected to the sewer system. The sewer system shall be extended as shown on the drawings.

1.2 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Manufacturer's cuts.

b. Installation instructions.

PART 2: PRODUCTS

2.1 QUALITY CONTROL:

a. All pipes used on this project shall be manufactured in the United States and be in compliance with the dimensional and quality standards cited in these specifications.

2.2 SOIL, WASTE, VENT AND DRAIN PIPING:

a. Soil, waste, vent and drain piping below grade shall be cast iron soil pipe.

1. All cast iron soil pipe shall be service weight ASTM A-74-69 bell and spigot, bearing the label of the Cast Iron Soil Pipe Institute. The casings shall be gray iron of good quality made by Cupola, Air Furnace or Electric Furnace Process. The resultant pipe shall be compact, close grained metal, soft enough to permit cutting and drilling. Pipe shall have been hydrostatically tested at not less than 50 pounds per square inch gauge. Factory coated by heating to 300 degrees F. and dripping in a bath of coal tar pitch and oil.

b. Soil, waste, vent and drain piping above grade shall be as follows:

1. Waste and vent lines above grade, 1-1/2" diameter and smaller shall be galvanized standard weight steel with malleable iron screw type fittings.

2. Waste and vent lines 2" and above shall be cast iron same as specified for below grade. At Contractor's option no-hub piping may be substituted for 2" and larger above grade waste and vent piping. Joints above grade may be made with no-hub bands using Type II heavy-duty stainless steel clamps. Bands and clamps shall conform to Cast Iron Soil Institute Standard 30l

c. Roof drain piping above grade shall be cast iron same as specified for below grade. Roof piping below grade as specified for soil, waste and vent piping.

d. Exposed vent piping shall be schedule 40 black steel Installed in a neat and workmanlike manner prime coated and ready for painting.

2.3 WASTE ARMS:

a. Waste arms serving lavatories, counter sinks and water coolers shall be threaded galvanized schedule 40 steel with schedule 40 drainage pattern fittings and adapters.

b. Waste arms serving urinals shall be standard pipe size threaded red brass pipe, with red brass threaded fittings.

2.4 SPECIALTIES:

a. Cleanout Plugs: Cleanouts shall be of the same size as the pipe except that cleanout plugs larger than 4" will not be required. Cleanouts shall consist of long sweep fittings to an easily accessible place.

b. Traps: Each fixture and piece of equipment including floor drains and hub drains, requiring connections to the drainage system shall be equipped with a trap placed as near to the fixture as possible. No fixtures shall be double trapped. Traps for floor drains and hub drains shall be deep seal "P" traps. All other traps shall be supplied under the "Fixture Paragraph".

c. Floor Flanges: Cast iron floor flanges shall be provided for connection of all floor outlet water closets. The joint between the closet trap and the floor flange shall be made tight with red or black rubber as made by Grinnell fixture setting gasket.

d. Flashing: Vent pipes shall be flashed and made watertight as the roof with 4 pound sheet lead. Flashing shall extend not less than 8" from the vent pipes in all directions. Flashing shall be extended up the vent pipes and shall be turned down into the pipe. Minimum vent through the roof shall be 2" size.

e. Floor Drains: Floor drains shall be sized as indicated on the drawings, and shall be Josam or equal. See plans for model number and size. Drains by Zurn or Wade will be acceptable.

PART 3: EXECUTION

3.1 PIPE INSTALLATION:

a. Horizontal drain and waste piping within the building shall be given a grade of 1/8" per foot below ground and 1/8" per foot above ceilings unless otherwise indicated on the drawings. Piping 3" and smaller shall have minimum grade of 1/4" per foot. Main vertical soil and waste stacks shall be extended full size to the roof line and 12" above as vents, unless otherwise indicated on the drawings. Fittings shall be service weight when used on service weight pipe. Reduction of the size of drainage piping in the direction of flow is prohibited. Vent or tap tees will not be permitted on waste lines.

3.2 JOINTS:

a. Joints between cast iron pipe and between cast iron pipe and fittings shall be made with neoprene push gaskets conforming to ASTM C-564.

b. Joints for galvanized pipe shall be threaded and have American National taper screw thread with graphite and oil compound applied to the male thread only.

c. Joints for red brass piping shall be made with American Standard taper pipe thread; apply lubricant on male thread only; burrs or cuttings shall be reamed or filled out to not less than original diameter - lubricant shall be red lead.

3.3 CLEANOUTS:

a. Cleanouts shall be installed where shown on the drawings but in no case shall they be more than 50 feet apart in piping 3" and under and 75 feet apart in piping 4" and larger.

3.4 PIPE TEST:

a. All new soil, waste, drainage and vent piping shall be tested before fixtures are installed by capping or plugging the openings and filling the entire system with water to a minimum height of 10 feet above grade or the highest fixture opening of the section being tested, and allowing it to stand thus filled for a period of four hours.

b. Pipe found defective during test shall be replaced at no additional cost to the Owner. Pipe joints found defective during tests shall be taken apart and remade.

End of Section

SECTION 22 4000

PLUMBING FIXTURES

PART 1: GENERAL

1.1 DESCRIPTION:

a. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all work in this Section.

b. The Contractor shall furnish and install all plumbing fixtures complete with all equipment, fittings, trimmings and supports as specified.

1.2 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Manufacturer's cuts.

b. Certified capacity ratings.

c. Installation instructions.

d. Operating and Maintenance Instructions.

PART 2: PRODUCTS

2.1 FIXTURES:

a. All fixtures shall be Grade "A". The name or trademark of the manufacturer shall be printed or pressed on all water closets and lavatories and a label, which cannot be removed without destroying it, containing the manufacturer's name and trademark and the quality of the fixtures, shall be affixed to all fixtures. Products shall be by manufacturers indicated on the drawings or approved equals by:

Lavatories, water closets Sinks and urinals	Kohler Eljay Crane
Faucets	T & S Brass, Zurn, Moen
Flushg Valves	Delany, Zurn, Sloan
Water Cooler	Oasis
Water Heater	Lochinvar, RBI
Cleanouts	MIFAB
Floor and Roof Drains	MIFAB
Hose Bibbs and Frost Proof Hydrants	MIFAB

Eyewash/Shower	Haws, Oasis
Shock absorbers	Smith, Watts
Trap primers	Zurn, A O Smith

Additional products will be considered for approval in accordance with prior approval provisions of the specifications.

b. Exposed metal parts of fixtures shall be chromium plated. Where fixtures are to be hung from the wall, the fixture or fixture hanger shall be supported by concealed 3" steel washers and through bolts. Furnish traps and supply fittings with stops for all fixtures.

c. All faucets and supply fittings shall be of the same manufacturer as the fixture except as noted otherwise. All exposed supply and waste piping shall be chrome plated. Supply piping serving flush valves shall be equipped with chrome plated pipe cover.

d. Fixtures shall be white or stainless steel as indicated on drawings.

e. Direct connections between domestic water system and sanitary waste system will not be permitted.

f. All enameled cast iron fixtures shall be Acid Resisting (AR) and shall bear manufacturer's symbol signifying AR materials.

g. All flush valves shall be quiet acting, non-hold open feature and shall have sweat solder adaptor kit. Escutcheon shall be chrome plated brass with set screws.

h. Threaded adaptors serving lavatory supply piping shall be concealed in walls. Runouts to fixture shall be chrome plated brass pipe.

i. All exposed waste piping serving fixtures, except service sinks, shall be 17 gauge chrome plated brass pipe with cast brass P-trap. Under Counters will be considered exposed areas.

j. Cut-Off Stops: All fixtures shall have individual loose key cut-off stops on cold and/or hot water lines except as specified hereinafter or indicated on the drawings.

k. Provide appropriate wall hangers for all wall-hung fixtures.

2.2 Gas fired water heater:

a. Natural gas water heater shall be State Ultra Force or equal as noted on the drawings. Unit shall have a minimum 95% thermal efficiency and a maximum hydrostatic working pressure of 160 PSI.

b. Water heater(s) shall:

1. Modulating gas burner that automatically adjusts the input based on demand

2. Have powered anodes that are non-sacrificial and maintenance free.

3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded.

4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IESNA 90.01.

5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve.

6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.

7. Be approved for 0″ clearance to combustibles.

c. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout.

d. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters.

e. Unit to meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IESNA 90.1. and comply with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

f. Water heater(s) shall be suitable for power direct venting using a 4” or 6” diameter concentric PVC pipe for vent and combustion air.

g. Water heater should incorporate the iCOMM™ system for remote monitoring, leak detection and fault alert.

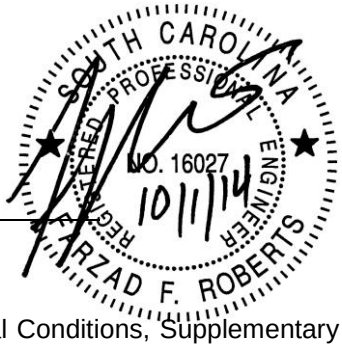
h. Units with an input capcity of 200,000 BTUH or more shall be constructed and stamped pursuant to the ASME Code, Section IV, or Section VIII, Division 1, as applicable.

PART 3: EXECUTION

3.1 GENERAL:

a. Install all fixtures as per manufacturer's requirements and local codes.

End of Section



SECTION 23 0500

COMMON WORK RESULTS FOR HVAC

PART 1: GENERAL

1.1 SCOPE:

a. Applicable requirements of the General Conditions, Supplementary General Conditions, and Special Conditions bound at the front of these specifications shall govern work under this heading.

b. The Contractor shall coordinate the work and equipment of this Division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation. Work such as excavation, backfill, concrete, flashing, wiring, etc., which is required by the work of this section shall be performed in accordance with the requirements of the applicable section of the specifications.

c. It is the intention of these specifications and drawings to call for finished work, tested and ready for operation. Whenever the word "provide" is used, it shall mean "furnish and install complete and ready for use".

d. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

e. This Contractor is referred to the General and Special Conditions of the Contract which shall form a part and be included in this section of the specification and shall be binding on this Contractor.

f. Some items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items or equipment as indicated on the drawings, and as required for complete systems.

g. Please refer to coordination process requirements in Division 1

1.2 DEFINITION:

a. The word "Contractor" as used in this section of the specification refers to the HVAC, Plumbing and Fire Protection Contractors unless specifically noted otherwise. The word "provide" means furnish, fabricated, complete, install, erect, including labor and incidental materials necessary to complete in place and ready for operation or use the item referred to or described herein and/or shown or referred to on the Contract Drawings.

1.3 CONTRACTOR'S QUALIFICATIONS:

a. It is assumed that the Contractor has had sufficient general knowledge and experience to anticipate the needs of a construction of this nature. The Contractor shall furnish all items required to complete the construction in accordance with reasonable interpretation of the intent of the Drawings and Specifications. Any minor items required by code, law or regulations shall be provided whether or not specified or specifically shown where it is a part of a major item of equipment, or of the control system specified or shown on the plans.

PART 2: PRODUCTS

2.1 MATERIALS AND WORKMANSHIP:

a. All materials and apparatus required for the work, except as specifically specified otherwise,

shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by the Architect shall be furnished.

b. The Contractor shall furnish the services of an experienced superintendent, who shall be constantly in charge of the installation of the work, together with all skilled workmen, fitters, metal workers, welders, helpers and labor required to unload, transfer, erect, connect-up, adjust, start, operate and test each system.

c. Unless otherwise specifically indicated on the plans or specifications, all equipment and material shall be installed with the approval of the Architect in accordance with the recommendations of the manufacturer. This shall include the performance of such tests as the manufacturer recommends.

d. All work must be done by first-class and experienced mechanics properly supervised and it is understood that the Architect has the right to stop any work that is not being properly done and has the right to demand that any workman deemed incompetent by the Architect be removed from the job and a competent workman substituted.

2.2 EQUIPMENT APPLICATION AND PERFORMANCE:

a. The Contractor and/or Equipment Supplier shall be responsible to see that equipment supplied is correct for the intended application and will perform within the limits of capacity, noise, life expectancy, pressure drop and space limitations intended for that equipment as shown on the plans or described in the specifications. The shop drawings shall show the capacity and operating characteristics of the equipment.

2.3 EQUIPMENT DEVIATIONS:

a. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings and detailing required therefor, shall be prepared by the Subcontractor at his own expense and submitted for approval by the Architect.

b. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

2.4 MOTORS:

a. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C40 and conform thereto for installation resistance and dielectric strength. Each motor shall be provided with conduit terminal box, adequate starting and protective equipment as specified or required. The capacity shall be sufficient to operate associate driven devices under all conditions of operation and load and without overload, and at least shall be the horsepower indicated or specified. Each motor shall be selected for quiet operation. All 3-phase motors be NEMA MG-1 Premium Efficiency rated.

2.5 DRIVES:

a. Machinery drives shall be provided for all power driven equipment specified in this section.

b. Drives shall be V-belt and shall be selected to overcome the starting inertia of the equipment without slippage, but in no case shall be less than 150% of the full motor load. Drives 1/2 HP and smaller may be provided with single belts. Drives 3/4 HP and larger shall be provided with the number of belts necessary to transmit the required power with 95% minimum efficiency.

c. Where adjustable type sheaves are indicated they shall be selected such that the schedule speed of the driven equipment is at the midpoint in the adjustment range of the sheave.

d. Where fixed type sheaves are indicated the Contractor shall include in his price changing sheave sizes once during the balancing period to achieve proper air quantities.

e. Sheaves shall be machined cast iron of the same manufacturer as the belt provided. Shop drawings shall be submitted of each drive which shall include actual transmission capacity of each drive.

All exposed belt drives to have belt guards

2.6 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS:

a. This Contractor shall furnish and install all necessary foundations, supports, pads, bases and piers required for all air conditioning equipment, piping, pumps, tanks, compressors, and for all other equipment furnished under this contract, and shall submit drawings to the Architect for approval before purchase, fabrication or construction of same.

b. For pumps, compressors, and other rotating machinery and for all equipment where foundations are indicated, furnish and install concrete pads minimum 4 inches thick or as shown. All pads shall be extended six (6) inches beyond machine base in all directions with top edge chamfered. Insert six (6) inch long, l/2" round steel dowel rods at 12" on center into floors to anchor pads. Shop drawings for all foundations and pads shall be submitted to the Architect for approval before same are constructed.

c. Construction of foundations, supports, pads, bases, and piers where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding flooring material.

d. All equipment, unless otherwise shown, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Architect, not strong enough shall be replaced as directed.

2.7 VIBRATION ISOLATION:

a. All work shall operate under all conditions of loads without any sound or vibration which is objectionable in the opinion of the Architect. If requested, the Contractor shall record sound power level readings in all areas adjacent to mechanical rooms, over, under or beside, after all equipment is fully operational and all wall and ceiling systems are completed. Sound level readings shall not exceed NC levels as recommended in Table 23, Chapter 35 of ASHRAE Handbook and Product Directory.

b. The readings are to be tabulated in the Maintenance and Operating Instruction Booklets.

c. Sound or vibration conditions in excess of listed quantities shall be corrected in an approved manner by the Contractor at his expense.

d. Unless otherwise noted mechanical equipment over one horsepower shall be isolated from the structure with resilient vibration and noise isolators supplied by one manufacturer to the Mechanical Contractor. Where isolator type and required deflection are not shown, equipment shall be isolated in

accordance with the latest ASHRAE Handbook and Product Directory, Chapter 32, Table 30. Submittals shall include complete design for the equipment bases, a tabulation of the design data for the isolators, including lateral stiffness, O.D., free operating and solid height of the spring isolators, free and operating height of the neoprene or fiberglass isolators. Selection of isolators for proper loading to obtain desired efficiency shall be the responsibility of the manufacturer of isolating units to suit the equipment being supplied on the job and shall be fully guaranteed by this supplier. All vibration isolation equipment complete with thorough selection data shall be submitted. Units shall be Vibration Eliminator Company, Mason, Peabody, or approved equal.

e. Flexible duct connections shall be provided at inlet and outlet of all fans or cabinets containing fans and shall be constructed such as to allow a minimum movement of 2 inches in any direction and will not restrict normal movement of any equipment.

2.8 DIELECTRIC CONNECTIONS:

a. Dielectric connections shall be used at any points within the piping systems where dissimilar metals meet. Careful attention shall be given to support brackets and hangers to select proper materials to avoid dissimilar metal contact at these points.

2.9 DRAINS AND VENTS:

a. In addition to the drains and vents indicated on the plans and piping details, the Contractor shall install additional drains and vents as required to remove all water and air from the piping systems.

2.10 MOTOR STARTERS AND DISCONNECTS:

a. Individual motor controllers complete with auxiliary contacts, control transformers, push buttons, selector switches and remote push button stations not specifically specified to be furnished with the equipment shall be provided under this section. Motor controllers shall comply with NEMA Standards and be complete with proper size heaters and auxiliary contacts and shall be in NEMA enclosures as required. Unless otherwise noted, push button stations shall be oil-tight heavy duty type. Controllers shall be manual, magnetic, or combination type with disconnect switch or circuit breaker as indicated on the drawings or where required by the NEC. Controllers shall include motor overcurrent protection in each phase conductor. Each motor controller shall be provided with phenolic nameplate, black with 1/4" high letters and white border, indicating equipment served, attached using counter sunk screws.

b. The Electrical Contractor shall furnish and install all disconnecting switches unless otherwise indicated or specified. Where disconnecting switches are indicated to be furnished under this Section, they shall be General Electric, Type TH in NEMA 1 enclosures, with voltage and amperage rating appropriate to the application. Unless otherwise noted, fuses shall be Buss "Fusetrons", or approved equal. Unfused motor disconnecting switches shall be Type TH in NEMA 1 or 4 applicable enclosures. Similar and equivalent equipment as manufactured by I.T.E., Square D, or Westinghouse is equally acceptable. Switches used as service switches shall bear such U.L. Label and nameplate on switch shall so indicate.

2.11 PAINTING:

a. Paint material shall be selected from the products listed below and, insofar as practical, products of only one manufacturer shall be used. Contractor shall submit to the Architect the listed manufacturer he proposes to use in the work. Should the Contractor desire to use products of a manufacturer not listed below, or products made by a listed manufacturer but not scheduled herein, Contractor shall submit complete technical information on the proposed products to the Architect for approval. Only products approved by the Architect shall be used.

1. Rust Inhibitive Primer:

    a. Devoe: Ready-Mixed Red
    b. Duron: Deluxe Red Primer.
    c. Glidden: Rustmaster Tank and Structure Primer.
    d. Pittsburgh: Inhibitive Red Primer.

2. Galvanized Metal Primer:

    a. Devoe: Devoe Zinc Dust Primer.
    b. Duron: Duron Deluxe Galvanized Metal Primer
    c. Glidden: Rustmaster Galvanized Iron Metal Primer.
    d. Pittsburgh: Speedhigh Galvanized Steel Primer.

2.12 FLOOR OPENINGS:

a. Openings in floors of mechanical rooms (duct and piping) are to be curbed with 4" high curbs.

PART 3: EXECUTION

3.1 DUTIES OF CONTRACTOR:

a. Contractor shall furnish and install all materials called for in these Specifications and accompanying drawings, and must furnish the apparatus complete in every respect. Anything called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications, must be furnished by the Contractor.

b. Contractor is responsible for familiarizing himself with the details of the construction of the building. Work under these specifications installed improperly or which requires changing due to improper reading or interpretation of building plans shall be corrected and changed as directed by the Architect without additional cost to the Owner.

c. The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space condition appear inadequate, Architect shall be notified before proceeding with installation.

d. The plans are diagrammatic and are not intended to show each and every fitting, valve, pipe, pipe hanger, or a complete detail of all the work to be done; but are for the purpose of illustrating the type of system, showing pipe sizes, etc., and special conditions considered necessary for the experienced mechanic to take off his materials and lay out his work. This Contractor shall be responsible for taking such measurements as may be necessary at the job and adapting his work to local conditions.

e. Conditions sometimes occur which require certain changes in drawings and specifications. In the event that such changes in drawings and specifications are necessary, the same are to be made by the Contractor without expense to the Owner, providing such changes do not require furnishing more materials, or performing more labor than the true intent of the drawings and specifications demands. It is understood that while the drawings are to be followed as closely as circumstances will permit, the Contractor is held responsible for the installation of the system according to the true intent and meaning of the drawings. Anything not entirely clear in the drawings and specification will be fully explained if application is made to the Architect. Should, however, conditions arise where in the judgment of the Contractor certain changes will be advisable, the Contractor will communicate with the Architect and

secure his approval of these changes before going ahead with the work.

f. The right to make any responsible change in location of apparatus, equipment, routing of piping up to the time of roughing in, is reserved by the Architect without involving any additional expense to the Owner.

g. It shall be the duty of prospective Contractors to visit the job site and familiarize themselves with job conditions. No extras will be allowed because of additional work necessitated by, or changes in plans required because of evident job conditions, that are not indicated on the drawings.

h. Contractor shall determine the schedule of work as laid down by the General Contractor and must schedule his work to maintain the building construction schedule so as not to interfere with or hold up any other Contractors.

i. Contractor shall leave the premises in a clean and orderly manner upon completion of the work, and shall remove from the premises all debris that has accumulated during the progress of the work.

3.2 CODES, RULES, PERMITS AND FEES:

a. The Contractor shall give all necessary notices, obtain all permits and pay all sales taxes, fees and other costs, including utility connections or extensions, in connection with his work; file all necessary plans prepare all documents and obtain all necessary approvals of all authorities having jurisdiction. Obtain all required certificates of inspection for his work and deliver same to the Architect before request for acceptance and final payment of the work.

b. The Contractor shall include in his work, without extra cost to the Owner, any labor, materials, service, apparatus, drawings, in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.

c. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, international building code, International Plumbing Code, International Mechanical Code, International Energy Conservation Code, International Fuel Gas Code (2003)and with the requirements of all governmental departments having jurisdiction.

d. All materials and equipment for the electrical portion of the mechanical system shall bear the approval label, and shall be listed by the Underwriters' Laboratories, Inc..

e. All work shall be done in accordance with the International Building Code, and requirements of governmental agencies having jurisdiction.

f. It shall be the responsibility of this Contractor to complete installation of the specified fired and unfired pressure vessels, and their safety devices, in accord with requirements of the State of South Carolina. Contractor shall have the equipment which is installed under this contract inspected and approved by the State of South Carolina. Contractor shall be responsible for notifying State Boiler Inspector in writing at least two weeks prior to date of completion of all equipment requiring inspection.

g. Furnish and install a suitable metal frame, having a removable glass cover, for posting certificates of inspection furnished by the State of South Carolina. Certificates are to be installed in frames by this Contractor before requesting final inspection of complete job by the Owner and Architect. Final payment will not be made until such certificate has been duly posted. All fees or expenditures necessary for this requirement shall be paid by this Contractor.

3.3 COOPERATION WITH OTHER TRADES:

a. This Contractor shall give full cooperation to other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

b. Where the work of the Contractor will be installed in close proximity to, or may interfere with the work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Architect, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 3/8" = 1'-0", clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordination with other trades, or so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.

c. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

3.4 RECORD DRAWINGS:

a. The Contractor shall furnish drawings showing dimensioned location and depths of all exterior piping and structures, and shall indicate any and all changes in location of piping, ductwork, equipment or valves from that shown on the Contract Drawings. The drawings shall consist of clean, legible sepia prints of the Contract Drawings on which the Contractor shall mark all notes, dimensions, sizes and information required. The sepias shall be kept for this purpose only. Before final inspection the Contractor shall submit to the Architect eight (8) sets of black line prints of the sepias.

3.5 SURVEYS AND MEASUREMENTS:

a. This Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

b. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Architect through the General Contractor, and shall not proceed with his work until he has received instructions from the Architect.

3.6 SAFETY REQUIREMENTS:

a. All systems shall be installed so as to be safe operating and all moving parts shall be covered where subject to human contact. All rough edges of equipment and materials shall be made smooth.

b. All safety controls shall be checked under the supervision of the Architect's representative and eight (8) copies of test date showing setting and performance of safety controls shall be submitted to the Architect. All pressure vessels shall be ASME stamped and shall have stamped relief valves. Water heaters shall be provided with ASME stamped T & P relief valve.

c. O.S.H.A. requirements will be complied with.

d. An emergency shutoff switch shall be provided at the door to each equipment room containing oil or gas burners. Activation of the switch shall cause each burner within that equipment room to cease operation.

3.7 SHOP DRAWINGS:

a. Contractor shall submit within ten (10) days after award of contract eight (8) copies of a

complete list of all manufacturers to be used on the job. No substitutions will be allowed after this date except in extenuating circumstances as determined by the Architect.

b. Submission of a manufacturer's name or equipment number on this list shall not be considered as equipment approved by the Architect.

c. The Contractor shall submit for approval eight (8) sets of detailed shop drawings of all equipment and all material required to complete the project, and no materials or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein. The Contractor shall furnish the number of copies required by the General and Special Conditions of the Contract, but in no case less than eight (8) copies.

d. Prior to delivery of any material to the job site, and sufficiently in advance of requirements to allow the Architect ample time for checking, submit for approval detailed, dimensioned drawings or cuts, showing construction, size, arrangement, operating clearances, performance, characteristics and capacity. Each item of equipment proposed shall be standard catalog product of an established manufacturer and of equal quality, finish, performance, and durability to that specified.

e. Samples, drawings, specifications, catalogs, submitted for approval, shall be properly labeled indicating specific service for which material or equipment is to be used, Section and Article number of specification governing, Contractor's Name and Name of Job.

f. Catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly marked. Data of a general nature will not be accepted. Data shall include eight (8) copies of computation sheets indicating how unit capacity was determined where ratings are at other than standard conditions. No payment for any equipment or labor will be allowed until all major pieces of equipment specified have been submitted to the Architect for approval.

g. The Contractor, as part of the shop drawing submitted, shall submit shop drawing of all ductwork for the project including the risers, takeoffs to the floors with their associated dampers, bottom of duct elevations, and ells with unequal legs showing turning vanes. Shop drawings to show complete assembled duct system on floor plans at minimum 1/8" per foot scale.

h. Static pressure drops across fittings, dampers, heaters, attenuators, etc. shall not exceed minimum ASHRAE Standards when not specified.

i. The submittal of shop drawings shall be with the Contractor stamp affixed, this shall assure the Engineer that they are being submitted in accordance with Sub-Paragraph 4.13.4 in AIA Document A201 and/or Paragraph 6.26, in NSPE Document 1910-8. This stamp indicates that the Contractor, by approving and submitting shop drawings, represents that he has determined and verified all field measurements and quantities, field construction criteria, material, catalog material, and similar data that he has reviewed and coordinated information in the shop drawings with the requirements of the work and the Contract Documents. It, also, indicates that any deviation from the Contract Documents has been shown on the submittal and clearly defines the deviations from the specifications.

j. Approval rendered on shop drawings shall not be considered as a guarantee of quantities, measurements, or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail: said approval does not in any way relieve the Contractor from his responsibilities or necessity of furnishing material or performing work as required by the contract drawings and specifications.

k. Failure of the Contractor to submit shop drawings in ample time for checking shall not entitle

him to an extension of Contract time, and no claim for extension by reason of default will be allowed.

l. All shop drawings and submittals are to be in the office of the Architect within 30 days after the Contracts have been awarded. Contractor shall be financially responsible for any price increase of shop drawing items from the time these drawings are issued until they are returned to the Contractor for purchase of items.

m. Contractor shall keep on the job at all times copies of all approved shop drawings.

3.8 OBSERVATION:

a. The project will be observed periodically as construction progresses. The Contractor will be responsible for notifying the Architect at least 72 hours in advance when any work to be covered up is ready for inspection. No work will be covered up until after observation has been completed on such items as piping and insulation, etc..

3.9 PERMITS, INSPECTION FEES, ETC.:

a. Contractor shall obtain and pay for all permits required, give all legal notices and pay all fees for inspection or otherwise required for the work.

b. It shall be the responsibility of this Contractor to complete installation of the specified fired and unfired pressure vessels, and their safety devices, in accord with requirements of the State of South Carolina. Contractor shall have the equipment which is installed under this contract inspected and approved by State of South Carolina, Contractor shall be responsible for notifying State Boiler Inspector in writing at least two weeks prior to date of completion of all equipment requiring inspection.

c. Furnish and install a suitable metal frame, having a removable glass cover, for posting certificates of inspection furnished by the State of South Carolina. Certificates are to be installed in frames by this Contractor before requesting final inspection of complete job by the Owner, and Architect.

d. Final payment will not be made until such certificate has been duly posted. All fees or expenditures necessary for this requirement shall be paid by this Contractor.

3.10 ACCESSIBILITY:

a. Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with the General Contractor and all other Contractors whose work is in the same space, and shall advise the General Contractor of his requirements. Such spaces and clearances shall; however, be kept to the minimum size required.

b. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to valves, traps, cleanouts, motors, controllers, switch-gear, and drain points. If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility and any change shall be submitted for approval.

c. The Contractor shall provide the General Contractor with exact locations of access panels for each concealed valve, control damper or other device requiring service. Access panels shall be provided and installed by the General Contractor and as specified in the Architectural sections of the specifications. Locations of these panels shall be submitted in sufficient time to be installed in the normal course of work.

3.11 CONCEALED PIPE:

a. In general, all pipe in finished spaces shall be run concealed in floors, walls, partitions and above ceilings.

b. Concealment of pipe and covering of same shall not be done until authorized by the Architect, after proper tests have been made. This applies to all interior work and exterior work.

3.12 CUTTING AND PATCHING:

a. This Contractor shall provide all cutting and patching necessary to install the work specified in this section.

b. No structural members shall be cut without the approval of the Architect and all such cutting shall be done in a manner directed by him.

c. This Contractor shall arrange for proper openings in building to admit his equipment. If it becomes necessary to cut any portion of building to admit his equipment, portions cut must be restored to their former condition by this Contractor through agreeable arrangement with the General Contractor.

d. The General Contractor will provide all openings or chases in masonry or concrete; however, it is this Contractor's responsibility to advise exact dimensions, shape and locations of openings required in sufficient time for the General Contractor to make the necessary provisions. This Contractor shall be responsible for correct size and location of each opening for his equipment even though these openings are provided by the General Contractor.

3.13 SLEEVES AND PLATES:

a. This Contractor shall provide and locate all sleeves and inserts required before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. This Contractor shall do all drilling required for the installation of his hangers.

b. Sleeves shall be provided for all mechanical piping passing through concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running imbedded in concrete or in insulating concrete slabs on grade.

c. Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed and made completely watertight.

d. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves pass insulated pipes, the sleeves shall be large enough to pass the pipe and insulation. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:

1. Terminate sleeves flush with walls, partitions and ceiling.

2. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor or as shown on the plans.

3. In all areas where pipes are exposed, extend sleeves 1/4 inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 3/4 inches above floor.

e. Sleeves shall be constructed of schedule 40 black steel pipe unless otherwise indicated on the drawings. Sleeves through concrete beams shall be constructed as indicated on the drawings.

f. Fasten sleeves securely in floor, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into the space between pipe and sleeve during construction.

g. Where piping penetrates fire rated floors or walls, penetrations shall be sealed with a U.L. approved fire stopping system. System shall be as manufactured and detailed by 3M Company or approved equal.

h. Escutcheon plates shall be provided for all exposed pipes and all exposed conduit passing through walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing through sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3.14 UTILITIES:

a. This Contractor shall bear the cost of utilities required to perform the work under this Contract. Where services such as electricity, hoist, etc. are provided by the General Contractor, he shall be responsible directly to the General Contractor for his portion of the utilities as may be agreed upon.

3.15 SCAFFOLDING, RIGGING, HOISTING:

a. This Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

3.16 EXCAVATING AND BACKFILLING:

a. Each trade shall perform all excavation and backfill required for the installation of its work.

b. Particular care shall be taken not to disturb or damage work of other Contractors.

c. Mass excavation to approximate levels will be carried out under a section of the architectural specifications. The Contractor shall, however, do all trench and pit excavation and backfilling required for work under this section of the specifications, inside and outside the building, including repairing of finished surfaces and all required shoring, bracing, pumping and all protection for safety of persons and property. State and OSHA Safety Codes shall be strictly observed. In addition, it shall be the responsibility of the Contractor to check the indicated elevations of the utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, the Architect shall be notified of such conditions and a redesign shall be made before excavations are commenced. It is also the responsibility of the Contractor to make the excavations at the minimum required depths in order to avoid undercutting the footings.

d. No backfilling shall be done until work involved has been tested and approved by the Architect.

e. Contractor shall schedule excavation work so as not to unduly interfere with work of other trades on the job. Contractor shall be responsible for establishing all lines and grades required for proper location of his work.

f. When rock is encountered in excavation, it shall be paid for as outlined under the architectural section of these specifications.

g. In backfilling pipe trenches, approved fill shall first be compacted firmly and evenly on both sides of pipe in 6" layers to a depth of 12" over the top of the pipe. Remainder of trench shall be

backfilled to established grade in 6" layers. Compact between each layer with a high-frequency vibrator tamper such as Dart Soil Compactor (as manufactured by Dart Manufacturing Company, Denver, Colorado). Fill shall be compacted to density specified under Earth Work Section of specifications for specified area through which trench passes. Compact fill to 95% maximum density at optimum moisture content all other areas. Earth bearing pressure as indicated shall be verified by a testing laboratory,which following the criteria specified for foundation wall trench, etc. in the Earth Work Section of the specifications. The reports shall be forwarded to the Architect for approval unless otherwise specified, the cost will be borne by this contractor, before any work is performed. If the earth bearing pressure is less than that required, the Contractor shall not begin additional work until notified by the Architect to do so. A copy of the report shall be forwarded to the Architect in triplicate.

h. Excess earth shall be distributed on premises as directed by the Architect.

i. Where ditches occur outside the building, the surface shall be finished to match existing surfaces. Any existing work, or work of other trades which is damaged or disturbed shall be repaired or replaced, and left in good order.

3.17 ELECTRICAL CONNECTIONS:

a. The Electrical Contractor shall furnish and install all wiring except: (1) temperature control wiring; (2) equipment control wiring and (3) interlock wiring. The Electrical Contractor shall receive from the Mechanical Contractor and mount all individually mounted motor starters and provide all power wiring to the motor terminals unless otherwise indicated. The Electrical Contractor will provide branch circuit protection and disconnects unless otherwise indicated or specified. The Mechanical Contractor shall provide all other control and protective devices, and perform all control and interlock wiring required for the operation of the equipment. Power wiring, from nearest panel, for control components (dampers, panels, etc.) shall be provided by the Mechanical Contractor unless specifically called for by Division 16.

b. After all circuits are energized and complete, the Electrical Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of this Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.

c. It shall be the responsibility of this Contractor to check with the Electrical Contractor on service outlets provided for this Contractor, to determine that the switches and wiring provided are of adequate size to meet Code requirements for this Contractor's equipment. Any discrepancy shall be brought to the attention of the Architect before work is installed. Otherwise, any cost for changes shall be at the expense of this Contractor, and in any case electrical cost increase due to equipment substitution of different electrical characteristics shall be this Contractor's expense.

3.18 PIPE WORK:

a. All pipe work shown on the drawings and/or specifications or implied herein and required for a complete and operating system shall be done by experienced mechanics in a neat and workmanlike manner and subject to the approval of the Architect.

b. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required and it shall be the responsibility of the Contractor to furnish and install all materials and equipment required for the operating systems.

c. The piping shall be installed as shown on the plans with strict conformity to the sizes listed and due provisions for expansion and contraction.

3.19 LUBRICATION:

a. All bearing, except those specifically requiring oil lubrication, shall be pressure lubricated. All lubrication points shall be readily accessible, away from locations dangerous to workmen. In areas where lubrication points are not readily accessible Contractor shall provide extended lubrication tubes to positions where lubrication can be easily accomplished. Pressure grease lubrication fittings shall be "Zerk-Hydraulic" type as made by the Stewart-Warner Corporation, or approved equal, for each type of grease required.

b. The Contractor shall furnish lubrication charts or schedules for each piece of equipment or machinery. The charts or schedules shall designate each point of lubrication. Eight (8) copies of charts and schedules shall be submitted to the Architect prior to final inspection and approved copies of each schedule and chart shall be framed by the Contractor in metal frames with glass front and installed in the Equipment Room.

3.20 PROTECTION:

a. The Contractor shall protect all work and material from damage, and shall be liable for all damage during construction.

b. The Contractor shall be responsible for work and equipment until all construction is finally inspected, tested and accepted. He shall protect work against theft, injury or damage; and shall carefully store material and equipment received on site which is not immediately installed. He shall close open ends of work including pipe, duct, or equipment with temporary covers or plugs during storage and construction to prevent entry of obstructing materials or dust and debris.

c. Provide a protective covering of not less than 0.004" thick vinyl sheeting (or a similar approved material) to be used in covering all items of equipment, immediately after the equipment has been set in place, (or if in a place of storage within the building under construction) to prevent the accumulation of dirt, sand, cement, plaster, paint or other foreign materials from collecting on the equipment and/or fouling working parts.

3.21 CLEANING:

a. Clean from all exposed insulation and metal surfaces grease, debris or other foreign material.

b. Chrome plated fittings, fixtures, piping and trim shall be polished upon completion.

3.22 LABELS AND INSTRUCTIONS:

a. Label all switches and controls furnished under this Section with engraved bakelite permanent labels to indicate the function of each and the apparatus serviced.

b. Post in the Equipment Room framed under glass the following:

1. Lubrication instructions listing all equipment which requires lubrication, the type of lubricant to be used and the frequency of lubrication.

2. Photostatic copy of wiring diagram of temperature controls.

3. Step-by-step operating instruction for each piece of equipment with control sequence description.

c. All units shall be marked with unit numbers in three inch high letters with unit designated numbers.

d. A tabulation shall be made of each panel number and circuit number serving each air conditioning unit, fan or other device with electrical service. This list shall be prepared and be ready to turn over to inspectors prior to calling for final inspection.

3.23 VALVE TAGS AND SCHEDULE:

a. Each valve shall be provided with an engraved black finish, phenolic valve tag indicating valve service and valve number. Tag lettering shall be at least 1/4" high etched white letters and bevelled white trim. Tags to be attached using brass chains.

b. The Contractor shall submit eight (8) copies of valve charts indicating valve number, location, service, "normal" position, manufacturer, size and model number to the Architect for approval.

c. Prior to final inspection an approved copy of each valve chart shall be framed by the Contractor in a metal frame with glass front and installed in the Equipment Room.

3.24 EQUIPMENT SERVICEABILITY:

a. All equipment shall be serviceable. All equipment shall be installed so that it can be removed. All equipment in or connected to piping systems shall have valves to isolate this equipment from the piping system. This includes, but not necessarily limited to control valves, water heaters, sensors, switches, pumps, traps and strainers. Unions (screwed or flanged) shall be provided so that all equipment is removable.

b. Equipment installed in walls, ceilings or floors shall be accessible for service or removal without cutting walls, etc..

c. Equipment requiring periodic service shall be installed to allow clearance for service and have removable panels, access doors, etc. through which the service is to be performed.

d. Elevated equipment shall have service platforms.

3.25 ACCEPTANCE OF EQUIPMENT:

a. In the event that the Architect considers it impractical, because of unsuitable test conditions, or some other factors, to execute simultaneous final acceptance of all equipment portions of the installation may be certified by the Architect for final acceptance when that portion of the system is complete and ready for operation.

b. Contractor shall make all necessary tests, trial operation balancing and balance tests, etc., as may be required as directed by the engineer to prove that all work under these plans and specification is in complete serviceable condition and will function as intended. Oil burners, gas burners, and water chillers shall be started by a representative of the equipment manufacturer. All costs of these procedures shall be borne by this Contractor.

c. Upon completion of all work the system shall be tested to determine if any excess noise or vibration is apparent during operation of the system. If any such objections are detected in the system or noisy equipment found, the Contractor shall be responsible for correcting same. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces. Equipment shall be wiped clean with all traces of oil, dust, dirt and paint spots removed. Temporary filters shall be provided for all fans that are operated during construction and after all construction dirt has been removed from the building, new filters shall be installed. Bearings shall be lubricated as recommended by the equipment manufacturer. All control valves and equipments shall be

adjusted to setting indicated. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.26 GUARANTEE:

a. The Contractor shall guarantee the complete mechanical system against defect due to faulty materials, faulty workmanship or failure due to negligence of the Contractor. This guarantee will exclude normal wear and tear, maintenance lubrication, replacement of expendable components, or abuse. The guarantee period shall begin on the date of the final acceptance and shall continue for a period of 12 months during which time the Contractor shall make good such defective workmanship and materials and any damage resulting therefrom, within a reasonable time of notice given by the Owner.

b. The period of Guarantee for equipment driven by electrical motors, etc., shall be 12 months from the date of acceptance. Refrigeration compressors shall have a five (5) year warranty.

3.27 OPERATING AND MAINTENANCE INSTRUCTIONS:

a. Submit 5 sets of complete operating and maintenance instructions.

b. Bind each set in plain black vinyl-covered, hard back, 3-ring binder. Individual paper shall be Boorum and Pease Reinforced Ring Book Sheet, No. S-212-101 or equivalent.

c. Organize material in the following format:

1. Section I:

   (a) Name of Project
   (b) Address
   (c) Owner's Name
   (d) General Contractor's Name and Address
   (e) Mechanical Subcontractor's Name and Address
   (f) Control Subcontractor's Name and Address
   (g) Warranty Dates

2. Section II:

   (a) Description of System

3. Section III:

   (a) Major Equipment List (name, manufacturer, serial no., H.P. and volta
   (b) Control Sequence Description
   (c) Routine Maintenance Instructions in Step-by-Step form
   (d) Lubrication Charts and Schedules
   (e) Valve Schedules
   (f) Test and Balance Reports
   (g) Sound Power Level Readings (where required)

4. Section IV:
   (a) Operating and Maintenance Instructions by Manufacturer
   (b) Shop Drawings (Major Requirement)
   (c) Wiring Diagrams
   (d) Control Drawings

3.28 PAINTING:

a. Painting shall be performed as detailed in Division 9.

b. All surfaces to receive paint shall be dry and clean.

c. Before priming, all surfaces shall be thoroughly cleaned of all dirt, oil, grease, rust, scale and other foreign matter. Cleaning shall be done with sandpaper, steel scraper, or wire brush where appropriate and necessary. Metallic surfaces which have been soldered shall be cleaned with benzol and all other metal surfaces washed with benzine.

d. Mixing shall be in galvanized iron pans. Paint shall be mixed in full compliance with manufacturer's directions. Thinning shall be done only in full compliance with manufacturer's directions.

e. Workmanship shall be highest quality, free from brush marks, laps, streaks, sags, unfinished patches, or other blemishes. Edges where paint joins other material or colors shall be sharp and clean without overlapping. Paint shall be brushed or sprayed on in strict compliance with manufacturer's directions and shall work evenly and be allowed to dry at least 48 hours before subsequent coating. Paint shall not be applied in damp or rainey weather or until surface has thoroughly dried. Contractor shall furnish and lay drop-cloths in all areas where painting is done as necessary to protect work of other trades. Varnish and enamel shall not be applied when temperature in the area is less than 60 degrees Fahrenheit nor paint when under 50 degrees Fahrenheit. Prior to final acceptance, Contractor shall touch up or restore any damaged finish. All insulation materials shall be provided with a paint suitable jacket.

f. The following materials and equipment require painting as noted:

1. All concealed piping, sheet metal, hangers and accessories except galvanized sheet metal or piping and tar coated cast iron piping:

(a) One coat rust-inhibitive primer except where exterior insulation is provided.

2. All exposed, exterior and interior, piping, sheet metal, hangers and accessories, air handling units, chillers, pumps, etc. except galvanized sheet metal or piping and tar coated cast iron piping:

(a) One coat rust-inhibitive primer except where exterior insulation is provided.

3. All concealed galvanized sheet metal, piping and accessories.

(a) One coat galvanized metal primer on threaded portions of piping and any damaged galvanized surfaces.

4. All exposed, exterior and interior galvanized sheet metal, piping and accessories.

(a) One coat galvanized metal primer except where exterior insulation is provided.

5. All tar coated cast iron piping, and accessories.

(a) Two coats tar coat paint on any damaged surfaces.

6. All exposed, exterior and interior, insulation equipment.

(a) Two coats exterior glass enamel over paint suitable insulation jacket.

g. All piping in Equipment Rooms shall be painted and identified by stenciling with letters

minimum 1/2" high in a contrasting color. Piping outside Equipment Rooms shall be stenciled. Stenciling shall occur at each change of direction and every 20 feet. Arrows should be placed adjacent to letters signifying direction of flow. Colors shall be as directed by the owner and according to the USC standards.

End of Section

SECTION 23 0548

VIBRATION ISOLATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SCOPE:

a. The work in this section consists of furnishing engineering and materials necessary for vibration isolation and seismic restraints for equipment contained herein for the project.

1. All mechanical equipment 3/4 HP and over listed in the Vibration Isolation / Seismic schedule shall be mounted on vibration isolators to prevent the transmission of objectionable vibration and vibration induced sound to the building structure.

2.. All isolation materials, flexible connectors and seismic restraints shall be of the same manufacturer and shall be selected and certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

3.. The contractor and manufacturer of the isolation and seismic equipment shall refer to the isolator and seismic restraint schedule which lists isolator types, isolator deflections and seismic restraint type. Vibration isolators shall be selected in accordance with the equipment, pipe or duct weight distribution so as to produce reasonably uniform deflections.

4. Install full line size flexible pipe connectors at the inlet and outlet of each pump, cooling tower, condenser, chiller, coiling connections and where shown on the drawings. All connectors shall be suitable for use at the temperature, pressure, and service encountered at the point of installation and operation. End fitting connectors shall conform to the pipe fitting schedule. Control rods or protective braid must be used to limit elongation to 3/8". Flexible connectors shall not be required for suspended in-line pumps.

5.. Unless otherwise specified, all mechanical, fire protection, and plumbing equipment, pipes, and ducts shall be restrained to resist seismic forces. Restraints shall maintain equipment, piping, and duct work in a captive position. Restraint devices shall be designed and selected to meet the seismic requirements as defined in the latest issue of the IBC or local jurisdiction building code.

b. SEISMIC RESTRAINT SHALL NOT BE REQUIRED FOR THE FOLLOWING:

1. Hanging, wall mounted, and flexibly supported mechanical, plumbing and components that weigh 20 pounds (89 N) or less, where I p = 1.0 and flexible connections are provided between the components and associated duct work, piping and conduit.

2. Piping supported by individual clevis hangers where the distance, as measured from the top of the pipe to the supporting structure, is less than 12 inches (305mm) for the entire pipe run and the pipe can accommodate the expected deflections. Trapeze or double rod hangers where the distance from the top of the trapeze or support to the structure is less than 12 inches for the entire run. Hanger rods shall not be constructed in a manner that would subject the rod to bending moments (swivel, eye bolt, or vibration isolation hanger connection to structure).

3. High deformability piping (steel, copper, aluminum with welded, brazed, grooved, or screwed connections) designated as having an Ip = 1.5 and a nominal pipe size of 1 inch or less where provisions are made to protect the piping from impact or to avoid the impact of larger piping or other mechanical equipment. Note, any combination of piping supported on a trapeze where the total weight exceeds 10 lb/ ft. must be braced.

4. High deformability piping (steel, copper, aluminum with welded, brazed, grooved, or screwed connections) and limited deformability piping (cast iron, FRP, PVC) designated with an Ip = 1.0 and a nominal pipe size of 1 inch and less in the mechanical equipment room, or 2" and less outside the mechanical equipment room.

5. PVC or other plastic or fiberglass vent piping.

6. HVAC ducts suspended from hangers that are 12 inches or less in length from the top of the duct to the supporting structure and the hangers are detailed to avoid significant bending of the hangers and their connections. Duct must be positively attached to hanger with minimum #10 screws within 2" from the top of the duct.

7. HVAC duct with an I p = 1.5 that have a cross-section area less than 4 square feet. HVAC ducts with an I P = 1.0 that have a cross sectional area of less than 6 square feet.

1.2.8. Equipment items installed in-line with the duct system (e.g, fans, heat exchangers and humidifiers) with an operating weight less than 76 pounds. Equipment must be rigidly attached to duct at inlet and outlet.

1.2. MANUFACTURER'S RESPONSIBILITIES:

a. Manufacturer of vibration and seismic control products shall have the following responsibilities:

1. Determine vibration isolation and seismic restraint sizes and locations.

2. Provide piping, ductwork and equipment isolation systems and seismic restraints as scheduled or specified.

3. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.

4. Provide calculations to determine restraint loads resulting from seismic forces presented in local building code or IBC, Chapter 16 latest edition. Seismic calculations shall be certified & stamped by an engineer in the employ of the seismic equipment manufacturer with a minimum 5 years experience and licensed in the project's jurisdiction. Provide calculations for all floor or roof mounted equipment, all suspended or wall mounted equipment 20lbs or greater, and vibration isolated equipment 20lbs or greater.

5. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges.

6. The professional engineer working for the seismic restraint supplier shall provide a Quality Assurance plan per section 1705 of the IBC 2003 for the seismic restraint system and he or his

designated representative shall make periodic inspections to assist the installing contractor in complying with the plan.

1.3 QUALITY CONTROL

a. The isolators and seismic restraint systems listed herein are as manufactured by Amber / Booth, Mason Industries, Kinetics, or approved equals which meet all the requirements of the specifications, are acceptable. Manufacturer must be a member of the Vibration Isolation and Seismic Control Manufacturers Association (VISCMA). Non-isolated seismic rated curbs by Imperial Metals are acceptable.

b. Steel components shall be cleaned and painted with industrial enamel. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

c. All isolators, bases and seismic restraints exposed to the weather shall utilize cadmium plated, epoxy coat or PVC coated springs and hot dipped galvanized steel components. Nuts, bolts and washers may be zinc-electroplated. Isolators for outdoor mounted equipment shall provide adequate restraint for the greater of either wind loads required by local codes or withstand a minimum of 30 lb. / sq. ft. applied to any exposed surface of the equipment.

1.4 SUBMITTALS

a. Submit shop drawings of all isolators, seismic restraints and calculations provided

b. The manufacturer of vibration isolation products shall submit the following data for each piece of isolated equipment: clearly identified equipment tag, quantity and size of vibration isolators and seismic restraints for each piece of rotating isolated equipment. Submittals for mountings and hangers incorporating springs shall include free height, rated deflections, and solid load. Submittals for bases shall clearly identify locations for all mountings as well as all locations for attachment points of the equipment to the mounting base. Submittals shall include seismic calculations signed and checked by a qualified licensed engineer in the employ of the manufacturer of the vibration isolators. Catalog cut sheets and installation instructions shall be included for each type of isolation mounting or seismic restraint used on equipment being isolated.

c. Provide shop drawings indicating location of all specification SC cable restraints (section 2.3.2) required for pipe and ductwork. Drawings must be stamped by manufacturer's registered professional engineer.

d. Mechanical, electrical and plumbing equipment manufacturers shall provide certification that their equipment is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic restraints.

PART 2: PRODUCTS

2.1. VIBRATION ISOLATORS

a. Specification W:a pad type mounting consisting of two layers of ribbed elastomeric pads with a ½" poro-elastic vibration absorptive material bonded between them. Pads shall be sized for approximate deflection of 0.10" to 0.18". Pads shall be Amber / Booth Type NRC.

b. Specification A: an elastomeric mounting having a steel baseplate with mounting holes and a threaded insert at the top of the mounting for attaching equipment. All metal parts shall be completely embedded in the elastomeric material. Mountings shall be designed for approximately 1/2" deflection, and incorporate a steel seismic snubber with all directional restraint. Mountings shall be Amber/Booth Type SRVD.

c. Specification B: an adjustable, freestanding, open spring mounting with combination leveling and equipment fastening bolt. The spring shall be welded to the spring mounting baseplate and compression plate for stability. The isolator shall be designed for a minimum kx/ky (horizontal-to-vertical spring rate) of 1.0. An elastomeric pad having a minimum thickness of 1/4" shall be bonded to the baseplate. Nuts, adjusting bolts and washers shall be zinc-electroplated to prevent corrosion. This type isolator must be used with specification SL seismic restraint. Isolators shall be Amber/Booth Type SW.

d. Specification C: a unitized adjustable, stable open spring isolator with a seismic restraint housing which serves as a blocking device during equipment installation. The spring package shall include an elastomeric pad for high frequency absorption at the base of the spring. The springs shall be designed for a minimum kx/ky (horizontal-to-vertical spring rate) of 1.0. Nuts, adjusting bolts and washers shall be zinc-electroplated to prevent corrosion. The spring assembly shall be removable with equipment in place and shall fit within a welded steel enclosure consisting of a top plate and rigid lower housing. Isolated seismic restraint bolts shall connect top plate to lower housing to resist seismic and wind forces in all directions and limit motion to a maximum of 1/4" movement before engaging. Surfaces that engage under seismic motion shall be cushioned with a resilient elastomeric pad or grommet to protect equipment. Top plate shall have adequate means for fastening to the equipment, and baseplate shall have adequate means for bolting to structure. Entire assembly shall be rated to exceed the applied seismic load (para 1.3). Seismic isolator shall be Amber/Booth Type CTER.

e. Specification D: an elastomeric hanger consisting of a rectangular steel box capable of 200% minimum overload without visible deformation, 30 degree rod misalignment and an elastomeric isolation element designed for approximately 1/2" deflection. Hangers shall be Amber/Booth Type BRD.

f. Specification E: a combination spring and elastomeric hanger consisting of a rectangular steel box capable of 200% minimum overload without visible deformation, 30 degree rod misalignment, coil spring, spring retainers and elastomeric element designed for approximately 1/2" deflection. The spring shall be designed for a minimum kx/ky (horizontal-to-vertical spring rate) of 1.0. Spring hangers shall be Amber/Booth Type BSRA.

g. Specification F: a set (two or more) of spring thrust resisting assemblies, which consist of coil springs, spring retainer, isolation washer, angle mounting brackets, and elastomeric tubing for isolating thrust resister rod from fan discharge. Thrust restraints shall be Amber / Booth Type TRK.

f. Specification SB: a unitized adjustable open spring isolator and a welded steel housing designed to resist seismic forces in all directions. Restraint surfaces which engage under seismic motion shall be cushioned with a resilient elastomer to protect equipment. Restraints shall allow a maximum of 1/4" movement before engaging and shall allow for the spring to be changed if required. Isolator shall be a stable spring with a minimum ky/ky of 1.0. The spring package shall include an elastomeric pad for high frequency absorption at the base of the spring. Nuts and bolts shall be zinc-electroplated to prevent corrosion. Bolting equipment to isolator with bolts smaller than main adjusting bolt will not be allowed.

Baseplate shall provide means for bolting to the structure. Entire assembly shall be rated to exceed the applied seismic load (para 1.3.). Mountings shall be Amber/Booth Type SWSR.

2.2 BASES

a. Specification G: a welded integral structural steel fan and motor base with NEMA standard motor slide rails and holes drilled to receive the fan and motor slide rails. The steel members shall be adequately sized to prevent distortion and misalignment of the drive, and specifically, shall be sized to limit deflection of the beam on the drive side to 0.05" due to starting torque. Snubbers to prevent excessive motion on starting or stopping shall be furnished if required; however, the snubbers shall not be engaged under steady running conditions. Bases shall be Amber/Booth Type SFB.

b. Specification H: a welded WF (main member) structural steel base for increasing rigidity of equipment mounted thereon or for unitizing belt driven fans. Fan bases shall have holes drilled to match fan and located to provide required center distance between fan and supplied NEMA standard motor slide rails. The steel members shall have minimum depth of 1/12 of the longest span, but not less than 6" deep. Junior beams and junior channels shall not be used. Cross members shall be provided where necessary to support the equipment or to prevent twisting of the main members. Where height restrictions prevent the use of members having a depth of 1/12 of the longest span, beams of less depth may be used provided they have equal rigidity. Provide height-saving brackets for side mounting of the isolators. Brackets for use with Specification type B isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. Bases shall be Amber/Booth Type WSB.

c. Specification J: a concrete inertia base consisting of perimeter structural steel concrete pouring form (CPF), reinforcing bars welded in place, bolting templates with anchor bolts and height-saving brackets for side mounting of the isolators. Brackets for use with Specification type B isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. The perimeter steel members shall have a minimum depth of 1/12 of the longest span, but not less than 6" deep. The base shall be sized with a minimum overlap of 4" around the base of the equipment and, in the case of belt-driven equipment, 4" beyond the end of the drive shaft. Fan bases are to be supplied with NEMA standard motor slide rails. The bases for pumps shall be sized to support the suction elbow of end suction pumps and both the suction and discharge elbows of horizontal split-case pumps. The bases shall be T-shaped where necessary to conserve space. Inertia bases shall be Amber/Booth Type CPF.

2.3 SEISMIC RESTRAINTS:

a. All seismic restraints shall comply with the latest edition of SMACNA Seismic Restraint Manual, *Guide for Mechanical Systems.*

b. Specification SL: a restraint assembly for floor mounted equipment consisting of welded steel interlocking assemblies welded or bolted securely to the equipment or the equipment bases and to the supporting structure. Restraint assembly surfaces which engage under seismic motion shall be lined with a minimum ¼" thick resilient elastomeric pad to protect equipment. Restraints shall be field adjustable and be positioned for 1/4" clearance as required to prevent interference during normal operation. Restraint assembly shall have minimum rating of 2 times the catalog rating at 1 G as certified by independent laboratory test. Restraint shall be Amber/Booth Type ER.

c. Specification SC: a restraint assembly for suspended equipment, piping or ductwork

consisting of high strength galvanized steel aircraft cable. Cable must have Underwriters Laboratories listed certified break strength, and shall be color-coded for easy field verification. Secure cable to structure and to braced component through bracket or stake eye specifically designed to exceed cable restraint rated capacity. Cable must be manufactured to meet or exceed minimum materials and standard requirements per AISI Manual for structural applications of steel cables and ASTM A630. Break strengths must be per ASTM E-8 procedures. Safety factor of 1.5 may be used when prestretched cable is used with end connections designed to meet the cable break strength. Otherwise safety factor 3.76 must be used. Cables shall be sized for a force as listed in section 1.3. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation. Restraint shall be Amber/Booth Type LRC.

2.4 ROOFTOP UNIT CURBS AND ISOLATION SYSTEMS

a. Specification X: Non isolated seismically rated rooftop curb system that is flashed into roofing membrane. Air and watertight curb shall have a neoprene sponge seal at the top and be rigid enough to provide continuous perimeter support for rooftop unit. Curb must provide means to positively anchor to concrete deck, or bolt or weld directly to structural steel to withstand seismic loading. Curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings. Curb shall use minimum 16 gage galvanized steel and shall be designed with crossbracing required to withstand the greater of seismic forces and/or wind loading per local building code. Design must be certified by registered professional engineer in the employ of the manufacturer. Seismic curbs shall be Amber/Booth Type RTC.

b. Specification Z: Seismically rated rooftop isolation curb system that is flashed into roofing membrane. Standard unit curb will not be used. Air and watertight upper curb shall have a neoprene sponge seal at the top and be rigid enough provide continuous perimeter support for rooftop unit. The upper curb shall be supported by type C isolators welded or bolted to continuous structural support which is positively anchored to concrete deck or bolted or welded to the structure to withstand seismic loading. An EPDM nylon reinforced air tight weatherproof seal shall consolidate the upper and lower curbs. Weatherproof access panel shall be provided at each isolator to allow isolator adjustment. Isolation curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings. Isolation curb shall use minimum 16 gage galvanized steel and shall be designed with crossbracing required to withstand the greater of seismic forces or wind loading per local building code. Design must be certified by registered professional engineer in the employ of the manufacturer. Isolation curbs shall be Amber/Booth Type RTIC.

2.5 FLEXIBLE PIPE CONNECTIONS

a. Specification K:

1. Water Service: For flanged connection – a double sphere arch rubber expansion joint constructed of molded reinforced neoprene with integral steel floating flanges, and designed to be suitable for pressures up to 225 PSI (4 to 1 safety factor) and temperatures up to 225 degrees F. Connectors shall have minimum movement capabilities of 1.77" compression, 1.18" lateral and 1.18" extension. Connectors shall provide a minimum 35 degree angular movement up to 6", minimum 30 degree up to 12" and minimum 20 degree up to 24". Spring loaded control units shall be furnished to limit movement to within allowables. Flex connector shall be Amber/Booth Type 2600.

2. Water Service: For threaded type – A double spherical rubber hose connector, minimum 8" long, constructed of molded neoprene, nylon cord reinforced, with female pipe unions each end.

Connectors shall have a minimum movement capability of 7/8" compression, 7/8" lateral, ¼" extension and 20 degree angular through 1-1/4", 13 degree through 2", and 9 degree through 3". Connectors shall be suitable for a maximum working pressure (4 to 1 safety factor) of 150 psi and 225 degree F. Connectors shall have cable control units to limit extension to ¼". Flex connector shall be Amber/Booth Type 2655.

b. Specification L: Steam and Condensate Service:

1. For flanged connection – a metal hose connector constructed of stainless steel hose and braid with carbon steel plate flanges. Live lengths shall conform to hose minimum length to absorb thermal and dynamic movement. Hose axis must be perpendicular to pipe movement. Flex connector shall be Amber/Booth Type SS-FP or SS-FW.

For threaded connections - a metal hose connector constructed of stainless steel hose and braid with carbon steel NPT threaded end fittings. Flex connector shall be Amber/Booth Type SS-PM.

c. Air Compressor Service:

1. For flanged connection – a flanged metal hose connector constructed of stainless steel hose and braid with carbon steel plate flanges. Connector shall be double braided with a minimum live length equal to four times the diameter. Connector shall be installed with the long axis perpendicular to the motion to be absorbed. Amber/Booth Type SS-FP (Special).

2. For threaded connection – a metal hose connector constructed of stainless steel hose and braid with carbon steel NPT threaded end fittings. Connector shall be double braided and have a minimum live length equal to four times the diameter. Connector shall be installed with the long axis perpendicular to the motion to be absorbed. Amber/Booth Type SS-PM (special).

PART 3: EXECUTION

3.1 GENERAL

a. Isolator and seismic restraints shall be installed as recommended by the manufacturer. Isolate all mechanical equipment 3/4 hp and over per the isolation schedule and these specifications.

3.2 PIPING ISOLATION

a. Horizontal Pipe Isolation: all HVAC pumped water, steam, pumped condensate, glycol, and refrigerant piping size 1 1/4" and larger connected to isolated equipment shall be isolated for the first 3 support locations from externally isolated equipment with specification E hangers or specification SB or SX floor mounts with the same deflection as equipment isolators (max 2").

3.2.2 Pipe Riser Isolation: All variable temperature vertical pipe risers 1-1/4" and larger, riser piping requiring isolation per para. 3.2.1 or where specifically shown and detailed on riser drawings shall be fully supported by specification B mounts with precompression plates. Steel spring deflection shall be .75 inch minimum except in those locations where added deflection is required due to pipe expansion and contraction. Spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs

shall be selected to keep the riser in tension. Pipe risers up through 16" shall be supported at intervals of every third floor of the building. Pipe risers 18" and over, every second floor. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Horizontal take-offs and at upper and lower elbows shall be supported with spring isolators as required to accommodate anticipated movement. In addition to submittal data requirements previously outlined, riser diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist if installed per design proposed. Riser supports shall be Amber/Booth Type SWP.

3.3 DUCT ISOLATION

a. Isolate all duct work with a static pressure 2" W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler. Use specification type E hangers or type SB (SX) floor mounts.

3.4 INSTALLATION

a. Comply with manufacturer's instructions for the installation and load application of vibration isolation materials and products. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary support during installation or shipping.

b. Locate isolation hangers as near the overhead support structure as possible.

c. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

d. Install isolated inertia base frames and steel bases on isolator units as indicated so that a minimum of 1inch clearance below base will result when supported equipment has been installed and loaded for operation.

e. Seismic Rated roof curbs shall be installed directly to building structural steel or concrete roof deck. Installation on top of steel deck or roofing material is not acceptable. Shimming of seismic rated curbs is not allowed.

f. Housekeeping Pads shall be constructed and installed per ASHRAE's "A Practical Guide to Seismic Restraint". They shall be a minimum of .5" thicker than the maximum embedment required of any anchor but not less than 6". They shall be sized to provide minimum edge distances for all installed anchors. They must be anchored to the floor structure in an approved manner.

g. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All anchor bolts to steel shall be ASTM A307 or better

3.5 APPLICATION OF SEISMIC RESTRAINTS

a. ISOLATED EQUIPMENT

1. All floor mounted isolated equipment shall be protected with type SB or type C unitized isolator and restraint or with separate type SL restraints (minimum of 4) in conjunction with type B isolators. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking.

2. All suspended isolated equipment and vessels shall be protected with specification SC restraints. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation.

3. Rigidly Mounted Equipment

A. Floor mounted equipment shall be protected by properly sized anchor bolts with elastomeric grommets provided by the isolation manufacturer. Suspended equipment shall be protected with type SC bracing.

b. PIPING

1. All piping not exempted by 1.1.b shall be protected in all planes by type SC restraints, designed to accommodate thermal movement as well as restrain seismic motion. (spring-loaded control rods should be used on flexible connectors in system). Tanks and vessels connected inline to piping shall be restrained independently. Locations shall be as determined by the isolator/seismic restraint supplier. and shall include, but not be limited to: (1) At a proximity to protect all drops to equipment connections. (2) At changes in direction of pipe as required to limit over stressing of pipe or movement that contacts other building material. (3) At horizontal runs of pipe, not to exceed the spacing as presented in Amber/Booth design criteria. (4) SMACNA design criteria. Seismic restraints shall not be required for piping exempted by paragraph 1.2.

2. Where riser pipes pass through cored holes, core diameters to be a maximum of 2" larger than pipe O.D. including insulation. Cored holes must be packed with resilient material or firestop as provided by other sections of this specification or local codes. No additional horizontal seismic bracing is required. Restrained isolators type C or SB shall support risers and provide longitudinal restraint at floors where thermal expansion is minimal and will not bind isolator restraints. For risers in pipe shafts, specification type SC cable restraints shall be installed at each level in a manner that does not interfere with thermal movement.

c. Duct work

1. Duct work 6 square feet and larger in cross sectional area (4 sq. ft. for systems with Ip=1.5) shall be protected in all planes by type SC restraints. Locations shall be determined by the isolator supplier and shall include, but not be limited to: (1) at equipment connections as required to protect the connections. (2) at all duct runs and duct run ends (transverse bracing and longitudinal bracing not to exceed spacing specified in Amber/Booth design criteria, or SMACNA guidelines).

All seismic restraints shall comply with the SMACNA Seismic Restraint Manual *Guidelines for Mechanical Systems*, Second Edition - February 1998.

3.6 SCHEDULES

See drawings for schedules.

End of Section

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE OF WORK

a. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of mechanical identification on all mechanical equipment, systems, and appurtenances where shown on the drawings and specified hereinafter.

b. Description:

1. Exposed piping is any piping which is not concealed in walls, chases, or above ceilings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

a. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work including:

1. Section 23 0500 – Common Work Results for HVAC

1.3 QUALITY ASSURANCE

a. Codes and Standards:

1. All work furnished and installed shall comply with all local codes and ordinances and shall meet or exceed the standards and procedures (latest editions) of the following:

a. ANSI A13.1 for the identification of piping systems.
b. OSHA color standards.

b. Manufacturer:

1. The following mechanical tag, band, nameplate, and identification marker manufacturers are acceptable:

a. Seton Name Plate Corporation
b. T&B/Westline Products
c. Brady

PART 2 - PRODUCTS

2.1 VALVES

a. Attach to each valve, except shut off valves on plumbing fixtures, a 1-1/2" round brass tag stamped with designating number, and system type, i.e. Chilled Water (HCHW), Hot Water Supply & Return (HHW, HWR), Domestic Cold Water and Hot Water (DCW, DHW) 1" high filled in with black enamel.

b. Plumbing and Heating Contractors shall coordinate valve numbering to avoid duplication.

2.2 NAMEPLATES

a. Nameplates shall be fabricated on black lamacoid with beveled edges. Markings shall be cut thru to white background.

b. Markings shall be 3/8" high minimum.

c. All information shall be scribed on a single nameplate per device.

2.3 MOTOR CONTROL IDENTIFICATION

a. Devices to be identified include:

1. Stand alone controllers and starters.
2. Factory mounted controllers and starter.

b. Nameplate shall include:

1. Distribution panel and breaker: EPP#1 - BKR #1

2.4 SWITCHES, THERMOSTATS AND OTHER DEVICES

a. Devices to be identified include:

1. Control panels.

2.5 PIPE CODING

a. Apply color coded polyvinyl chloride pipe bands identifying service and direction of flow.

b. Pipe identification sizing shall be:

OUTSIDE DIAMETER OF PIPE OR COVERING	FIELD INCHES	LENGTH OF COLORED SIZE OF LETTERS INCHES
3/4 to 1-1/4	8	1/2
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10	32	3-1/2

c. Flow direction arrows shall be black on color background. Show flow direction arrows immediately adjacent to all pipe identification markers.

d. Markers shall be self-sticking type.

e. Domestic hot water lines which are electrically heat traced shall have pipe labels located per specifications. Label shall state "Electric Traced."

2.6 LOCATION MARKERS

a. Provide approved ceiling tile markers near removable ceiling panels to indicate the location of valves, concealed HVAC equipment, fire and smoke dampers, or other devices. Markers shall be adhesive type of various colors.

PART 3 - EXECUTION

3.1 PIPE CODING

a. On exposed piping apply bands at 20 foot centers on straight runs, at valve locations, and at points where piping enters and leaves a partition, wall, floor or ceiling.

b. On concealed piping installed above removable ceiling construction, apply bands in the manner for exposed piping.

c. On concealed piping installed above nonremovable ceiling construction, or in pipe shafts, apply bands at valves or other devices that are made accessible by means of access doors or panels.

d. Apply bands at exit and entrance points to each vessel, tank or piece of equipment.

e. For insulated pipes apply bands after insulation and painting work has been completed.

f. Follow manufacturer's instructions for application procedures using noncombustible materials and contact adhesives.

g. Provide 10 additional bands of each type for Owner.

3.2 VALVES

a. Securely fasten valve tag to valve spindle or handle with a brass chain or cable.

b. Bind with metal clamp.

c. Furnish to Owner's Representative three (3) complete framed plastic laminated valve tag schedules. Schedule shall indicate tag number, valve location by floor and room number, valve size and service controlled.

3.3 CEILING MARKERS

a. Ceiling markers shall be attached to the ceiling grid as close to indicated equipment as possible.

3.4 NAMEPLATES

a. Submit listing of all nameplates with associated information to A/E for approval before fabrication.

b. Mount lamacoid nameplates with chromium plated acornhead screws.

c. Coordinate method of attachment and location of nameplate with Owner.

End of Section

SECTION 23 0593

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1: GENERAL

1.1 SCOPE:

a. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all the work in this Section.

b. The Contractor shall obtain the services of an independent NABB or AABC certified testing and balancing organization, headed by a Professional Engineer, under whose direction and supervision the balancing and testing of the systems shall be conducted. The independent organization shall have no affiliation with the Mechanical or Sheet Metal Contracting firm on the job and shall be responsible for compiling, verifying and submitting all the final readings required by the Specifications for approval.

c. Before commencing with the balancing of the systems, the Contractor shall submit for approval the name of the testing and balancing organization under whose direct supervision the adjustments as specified shall be made. The submission shall also include the methods and a list of instruments proposed to be used to adjust and balance the air systems. The list of instruments shall include serial numbers and dates of calibration. All instruments shall be calibrated within six months before tests. The Contractor shall also submit the testing report of all the instruments to be used on this project, performed by a testing agency in the last six months, to the Architect for his approval.

d. Six copies of complete balancing data shall be delivered to the Architect for approval of balancing of all systems.

e. Where test result indicate that air quantities at any system fan are below or the excess of the specified amount, the Contractor shall, at his own expense, change driving pulley ratio or shall make approved changes to obtain the specified or scheduled air quantities.

f. The air flow of any outlet shall not vary more than 10% from the quantity shown on the plans. If, on inspection by the Architect it is found that any outlet does not come within the stated tolerance, the entire system shall be declared out of balance and shall be readjusted until some has been balanced to satisfy the above condition. In the event that a system has been declared out of balance, an application for reinspection, a revised tabulation of readings as previously specified shall be included.

g. The independent organization shall thoroughly review the location of all fresh air dampers, return dampers, spill dampers, quadrant dampers, splitter dampers, bypass dampers, face dampers, fire dampers, registers, grilles, diffusers, variable volume. The purpose of the review is to finalize the optimum locations for dampers and balancing valves shown on the drawings.

1.2 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Manufacturer's cut sheets for all equipment to be used.

b. Sample balancing charts and forms.

c. Completed final balancing data.

PART 2: PRODUCTS

2.1 INSTRUMENTATION:

a. Instruments for use in the test and balancing procedures shall be of first quality and be accurately calibrated at the time of use. The following list is provided to indicate the instruments expected, however, other instruments as necessary to properly perform the work will be provided and subject to approval of the Architect.

1. Inclined manometer calibrated in no less that .006-inch divisions.

2. Combination inclined and vertical manometer (0 to 10 inch is generally the most useful).

3. Pitot Tubes. (Usually and 18 and 48 inch tube covers most balance requirements.

4. Tachometer. This instrument should be of the high quality self-timing type.

5. Clamp-on ampere meter with voltage scales.

6. Deflecting vane anemometer.

7. Rotating vane anemometer.

8. Thermal type (hot wire) anemometer.

9. Hook gage.

10. Dial and glass stem thermometers.

11. Sling psychrometer.

b. The accuracy of calibration of the field instruments used is of the utmost importance. All field instruments used in the balance should have been calibrated at least within the previous three months. Naturally, any suspect instruments should be checked more frequently.

PART 3: EXECUTION

3.1 SYSTEM START-UP:

a. Starting date for mechanical system shall be scheduled well in advance of expected completion date and shall be established a minimum of two weeks prior to acceptance date. The system shall be in full operation with all equipment functional prior to acceptance date.

b. Performance readings shall be taken and recorded on all air and water distribution devices and the system shall be balanced out prior to acceptance. Balancing of the system shall be accomplished with duct dampers and only minor adjustments made with grille dampers. Record and submit results in table form along side of scheduled quantities.

c. All controls shall be calibrated by qualified personnel prior to acceptance date. Thermostats shall be in close calibration with one another and shall operate their respective units without interference from adjacent units.

d. TAB report should include a full static pressure profile of each AHU showing pressure drops across dampers, filters, coils, fans, etc. All units shall be checked out thoroughly and the following

information recorded on each machine. Check sheets shall be included in Operating and Maintenance instructional Manual.

1 Coils (Each):

(a) Unit Number and Location
(b) Manufacturer and Model No.
(c) Return Air, Supply Air and Outside Air Temperature
(d) Discharge Temperature, Cooling or Heating
(e) Air Flow CFM, Entering and Leaving Static Pressure

2. Fans and Miscellaneous:

(a) Unit No. and Use
(b) Manufacturer and Model
(c) Motor Nameplate Data
(d) Motor Amps and Volts
(e) Entering and Leaving Static Pressure
(f) Fan RPM
(g) Damper Operation

e. Contractor shall have in his possession a copy of a letter from the responsible Control Representative stating that the controls have been installed according to the plans; that the control sequence has been checked and that all controls have been calibrated.

f. Each unit shall be marked with 3" high letters in accordance with mechanical plan designation. Each panel and breaker number for all equipment shall be marked. Each control device shall be labeled.

End of Section

SECTION 23 0700

INSULATION

PART 1: GENERAL

1.1 DESCRIPTION:

a. This section of specifications and related drawings describe requirements pertaining to insulation.

b. Provide all insulation in conjunction with equipment, piping and ductwork furnished under this division.

c. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all the work in this section.

1.2 QUALITY ASSURANCE:

a. Products of the manufacturers listed under MATERIALS will be acceptable for use for the specific functions noted. Adhesives, sealers, vapor barriers, and coatings shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such material in either the wet or dry state.

b. Materials shall be applied subject to their temperature limits. Any methods of application of insulating materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.

c. Insulation shall be applied by experienced workers regularly employed for this type of work.

1.3 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Catalog cuts.

b. Materials ratings.

c. Insulation instructions.

1.4 RATING:

a. Insulation and accessories such as adhesives, mastics, cements, tape and jackets, unless specifically expected, shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50. Materials that are factory applied shall be tested individually. No fugitive or corrosive treatments shall be employed to impart flame resistance.

b. Flame spread and smoke developed ratings shall be determined by Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255, ASTM E-84, UL 723.

c. Products of their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

d. Treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use or water-soluble treatment is prohibited.

e. Certify in writing, prior to installation, that products to be used will meet RATING criteria.

PART 2: PRODUCTS

2.1 PIPE INSULATION:

a. a. Materials shall be heavy density fiberglass with an all-service jacket composed of an outer layer of vinyl, fiberglass scrim cloth, aluminum foil, and kraft paper, in that order, from outside to inside of pipe covering.

1. Domestic cold water supply, hot water supply and return.

3. Roof drain leaders to the last vertical drop and Sanitary waste piping serving drains handling cold condensate.

b. Thicknesses:

1. Domestic cold water supply, domestic hot water supply and return, roof drain leaders, - inside only, Sanitary waste piping serving drains handling cold condensate - Pipe size 2" and larger - 1-1/2", Pipe size 1 1/2" and smaller - 1"..

8. All pipe insulation thicknesses shall meet or exceed paragraph requirements of the 2012 International Energy Conservation Code.

2.2 EQUIPMENT:

a. Pump and other equipment handling chilled water. Insulate with closed cell polystyrene blocks cut to fit and finished with 8 oz. canvas jacket. Pump insulation shall be removable to allow servicing of pump.

b. Tanks and other equipment handling hot water (not factory insulated). Insulate with semi-rigid fiberglass board l-l/2" thick. Cut to fit and cover with 8 oz. canvas jacket.

2.3 DUCT INSULATION:

a. Materials. Insulation shall be Owens-Corning as specified hereinafter or products of Certain-Teed/St. Gobain or Johns Mansville. Adhesives shall be as manufactured by 3-M Foster or Insulation Manufacturer. Insulation shall have composite (insulation, jacket and adhesive) fire and smoke hazard rating as tested by ASTM E-84, not exceeding Flame Spread -25 and Smoke Developed -50.

b. All duct insulation thicknesses shall meet or exceed paragraph requirements of the 2012 International Energy Conservation Code.

PART 3: EXECUTION

3.1 PIPE INSULATION:

a. Application:

1. Insulation and surfaces to be insulated shall be clean and dry when insulation is installed and during the application of any finish.

b. Fiberglass Insulation:

1. All fiberglass pipe covering shall be furnished with self-seal lap and 3" wide butt joint strips. The release paper is pulled from adhesive edge, pipe covering closed tightly around pipe and self-seal lap rubbed hard in place with the blunt edge of an insulation knife. This procedure applies to longitudinal as well as circumferential joints. Under no circumstances will staples be allowed. Care shall be taken to keep jacket clean, as it is the finish on all exposed work. All adjoining insulation sections shall be firmly butted together before butt joint strip is applied, and all chilled water and cold water service lines shall have vapor seal mastic thoroughly coated to pipe at butt joints every 21' and at all fittings. All insulation outside shall be protected with aluminum weather-proof jacketing with lap-seal, and factory attached moisture barrier. The aluminum shall be .016 gauge (3303-H14 alloy) of embossed pattern. It shall be applied with a 2" circumferential and 1-1/2" longitudinal lap and be secured with aluminum bands 3/8" wide 8" o.c.. All elbows shall be covered with the same .016 aluminum with factory applied moisture barrier. All fittings, valve bodies, unions, and flanges shall be finished as follows:

(a) Apply molded or segmental insulation to fittings equal in thickness to the insulation on adjoining pipe and wire in place with 2#14 copper wires.

(b) Apply a skim coat of insulating cement to the insulated fitting, if needed, to produce a smooth surface. After cement is dry, apply Owens-Corning Fiberglass Fitting Mastic, Type C, UL labeled.

(c) Wrap the fitting with fiberglass reinforcing cloth overlapping the preceding layer by 1 to 2". Also, overlap mastic and cloth by 2" on adjoining sections of pipe insulation.

(d) Apply a second coat of mastic over cloth, working it well into mesh of cloth and smooth the surface. Mastic to be applied at the rate of 40 square feet per gallon. All flanges and fittings on hot and cold lines in utility tunnels shall be insulated according to above. Omit insulation on flanges and unions over 60 degrees F. If painting is required, no sizing is necessary. To maintain the non-combustibility of the system only Glidden acrylic latex paint (#5370) is to be used.

(e) All piping exposed to view (equipment rooms, etc.) shall be covered with an 8 oz. canvas jacket.

d. Roof drain bodies shall be insulated with insulating cement.

3.2 DUCT INSULATION:

a. Duct insulation R values and thickness must meet or exceed the requirements of 2012 International Energy Conservation Code.

b. All vapor barriers and joints shall be sealed to prevent condensation. Clean and dry all ductwork before installing insulation. All weld joints shall be wire brushed and give one (1) coat of red lead before insulating. Staples will not be permitted in insulation.

c. Lined Duct:

1. All ducts are to be wrapped. Do not use duct liner.

d. Wrapped Duct:

1. All ducts (except exhaust ducts) unless noted otherwise on plans shall be insulated by wrapping with 2" thick fiberglass with vapor barrier jacket with joints overlapped a minimum of two

inches. Insulation shall be adhered to duct with non-combustible insulation bonding adhesive applied in 4" strips, 8" on center. All joints shall be secured with flare door staples on 3" centers through all laps over tape. Use mastic for securing insulation. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands. Provide rigid board insulated where exposed in mechanical rooms.

2. Ductwork exposed to weather shall be insulated as follows: Seal all joints with hard cast sealer, apply 2" thick polystyrene insulation cover with two (2) individual layers of glassfab and white mastic. Paint to match background color.

3. Insulation finish color in exposed areas to be selected by the architect.

e. Supply Diffusers:

1. Insulate supply air diffuser bodies similar to the duct system to protect against the possibility of condensation.

End of Section

SECTION 23 3000

HVAC AIR DISTRIBUTION

PART 1: GENERAL

1.1 SCOPE:

a. Furnish and install all sheet metal work shown or called for including ductwork and connections to fans and equipment.

b. Ductwork shall be provided and installed as shown on the drawings. All details of ductwork are not indicated, and necessary bends, offsets and transformation must be furnished whether shown or not.

c. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all the work in this Section.

1.2 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Manufacturer's cuts.

b. Certified capacity ratings.

c. Installation instructions.

1.3 RELATED DOCUMENTS:

a. Section 23 0700 – HVAC Insulation.

PART 2: PRODUCTS

2.1 GENERAL:

a. All ductwork, plenums and casings shall be constructed of sheet metal, as herein specified. All sheet metal construction shall conform to the pressure classification shown on the contract drawings, or herein specified and shall be in accordance with the construction and installation details in Chapter 1 of the 1983 ASHRAE Handbook or the appropriate SMACNA Standards.

2.2 LOW PRESSURE DUCTWORK:

a. Low pressure ductwork shall be constructed of zinc coated sheet steel and shall conform to the 1st Edition of SMACNA HVAC Duct Construction Standards, as follows:

1. Rectangular Duct:

(a) 1" w.g. pressure class - Table 1-4 ex.

(b) 2" w.g. pressure class - Table 1-5 ex.

Unless otherwise noted, all low pressure rectangular ductwork shall be constructed according to the 1" w.g. pressure class.

2. Round Duct:

(a) 2" w.g. pressure class - Table 3-2.

2.3 GENERAL EXHAUST DUCTWORK:

a. Unless otherwise noted, all exhaust ductwork shall be constructed the same as specified for low pressure ductwork.

2.4 EXPOSED DUCTWORK:

a. Where round or flat oval ductwork is called for on plans, it shall be prefabricated spiral lock seam conduit with prefabricated fittings as manufactured by United Sheet Metal Co., Inc. or equal.

b. Construction shall be an airtight, outer pressure shell, a l" insulation layer, and a perforated metal inner liner that completely covers the insulation throughout the system. The outer shell shall be manufactured from galvanized steel meeting ASTM A-517-67.

c. Fittings shall be manufactured to published standards for dimensions and construction details. Installation manuals shall be supplied to the Contractor to provide detailed instructions on methods and procedures for assembly.

d. All seams in the pressure shell of all fittings are to be continuously welded. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant aluminum paint.

e. Inner liners of both duct and fittings are to be adequately supported by metal spacers welded in position to maintain spacing and concentricity.

f. Provide an inner coupling to align the inner lining to maintain good air flow conditions equivalent to standard round high pressure duct joints.

g. Openings shall be factory cut and framed for the grille mounting bracket and the framing shall not have excessive welding that will be noticeable beyond the grille frame.

h. All exposed duct shall be mill phosphatized so as to accept painting by the General Contractor.

i. 90 degrees elbows shall be 5 piece gored elbows.

j. All joints shall be sealed using Benjamin Foster 30-02 sealed between screwed metal seams banded with fiberglass tape.

2.5 FLEXIBLE DUCTWORK:

a. Flexible air duct for connections between medium pressure duct and terminals units and between low pressure duct to diffusers shall be equal to Thermaflex M-KE. Duct shall be listed by Underwriter's Laboratories under UL 181 standards as Class 1 flexible air duct material and shall comply with NFPA Standards 90A and 90B. Duct shall be rated to operate at pressures up to 6" w.g. for sizes 10" and 4" w.g. for sizes 12" and above. Maximum length of flexible air duct shall be 6 feet.

b. Duct shall be a factory fabricated assembly composed of a polymeric liner duct bonded permanently to a coated spring steel wire helix and supporting a fiberglass insulating blanket. Outer vapor barrier shall be of fiberglass reinforced film laminate. Connections shall be made with Thermaflex, or equal, duct straps.

2.6 FIRE DAMPERS:

a. Furnish and install, at locations shown on plans, or where required by code, fire dampers constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have either a 1-1/2 hour or 3 hour fire protection rating (based on wall or floor rating) 212 degrees F. fusible line, and shall include a UL label in accordance with established UL labeling procedures. Damper manufacturer's literature submitted for approval prior to installation shall include comprehensive performance data developed from testing in accordance with AMCA Standard 500 and shall illustrate pressure drops for all sizes of dampers required at all anticipated airflow rates. Fire dampers shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing steel sleeves, angles, other materials and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. Fire dampers shall be style "A", "B" or "C" as required.

2.7 TURNING VANES:

a. Turning vanes and Deflector Controls, Barber-Colman, Carnes Corporation, Kruger or Titus in length up to 18"; Aero-Dyne Duro-Dyne, or Airsan double thickness about 24" in length, installed in rails.

2.8 FLEXIBLE CONNECTIONS:

a. Flexible duct connections shall be provided where ductwork connects to equipment; ventifabrics or Duro-Dyne 28 ounce minimum waterproof and fire retardant woven glass fabric double coated with neoprene, approved by UL. Maximum length of flexible connections shall be 10 inches.

2.9 MANUAL AND MOTOR OPERATED DAMPERS:

a. American Warming and Ventilating Company Type DAA-P-50, opposed blade, constructed with 15 gauge steel blades. Manual dampers shall be provided with Ventlock No. 637 hand operated locking quadrants located outside of ducts. Locking quadrants shall be elevated 1-1/2" for insulation. Manual dampers 18" x 10" or smaller may be single blade type construction of 16 gauge galvanized sheet metal. Dampers of Ruskin, Krueger, Louvers and Dampers, or Advanced Air, Inc. will be acceptable.

2.10 SPLITTER DAMPERS:

a. Install where shown and at duct splits; provide with Ventlock No. 690 self-locking device; constructed of 16 gauge galvanized steel with hemmed leading edge and reinforced at hinged side.

2.11 GRILLES, REGISTERS AND DIFFUSERS:

a. Grilles, registers and diffusers shall be of the type, size and design as shown on the drawings and/or as specified below. Grilles within the same room or areas shall be of the same type and style to provide architectural uniformly.

b. Each supply, return and exhaust device shall be of the proper design as indicated to handle quantities of air within the space with maximum diffusion and without objectionable air movement or noise level.

c. Each supply outlet and resister shall have a volume damper control operable from the front of the device with removable key. Where indicated on the drawings, all side wall registers shall be equipped with deflectors.

2.12 BALANCING DAMPERS OVER HARD CEILINGS

a. To provide a means of balancing airflow in ductwork above inaccessible ceilings, the contractor shall furnish the model EBD remote balancing damper assembly with a visual damper position indication meter manufactured by Young Regulator (or approved equal).

The Remote Damper Assembly shall consists of a commercial quality damper actuated by a 12V DC motor with position feedback, a plenum rated cable with RJ-25 connectors, termination options to control the damper from a plenum, wall or ceiling, and a hand held positioner that provides DC voltage to open and close the damper while displaying the damper position with the LCD position indicator meter.

The damper shall be either the round or rectangular. Round dampers to be 20 ga. galvanized steel shell and blade with ½" plated steel damper shafts, and the 12V DC Motor with position feedback. The rectangular dampers to be 20 ga. aluminum frame and blade, stainless steel slide, 18 gauge galvanized steel mounting plate for slip in installation, and the 12V DC motor with position feedback.

The connection cable to be a plenum rated cable with modular connectors, available in lengths to 1000'. One modular connector is attached to the motor and the other end is a RJ-25 modular connector that is installed inside a ceiling receptacle.

The Positioner uses a modular RJ-25 connector that plugs into the modular connector from the 12V DC motor. It houses a high capacity replaceable lithium battery that drives the motor open and closed. The positioner also houses the LCD display that provides precise damper position indication throughout the range of movement via a proportional voltage feedback signal from the motor.

PART 3: EXECUTION

3.1 DUCTWORK:

a. All ductwork shall be provided in a neat workmanlike manner. The ducts shall be properly braced and reinforced. All slip joints shall be made in the direction of flow. All ducts shall be true to the dimension indicated and shall be straight and smooth on the inside with neatly finished airtight joints. The ducts shall be securely anchored into the building construction in an approved manner and shall be completely free from vibration under all conditions of operation. All supply, return fresh-air and exhaust systems shall be completely balanced.

b. No duct transformation shall be of a ratio less than four to one and where possible, shall be of a ratio of six to one. No less than three vertical splitters shall be provided where these ratios cannot be met. No elbow shall have a throat center line radius of less that one and one-half times the duct width at the turn. All turns of less than this amount in rectangular duct shall be provided with duct turning vanes of standard design. Splitters or multi-blade volume dampers, where indicated, shall be provided in all branch.

c. Turning vanes shall be provided at all tees and square elbows. Turning vanes shall be factory fabricated and designed in accordance with the SMACNA or ASHRAE Guide for formed vanes. The first set of turning vanes on the leaving side of fans shall be of the acoustical type to aid in the elimination of unit noise with the exception of room fan coil units.

d. Splitter dampers and volume extractors shall be provided in all low velocity ductwork for proper air distribution. Each damper shall be provided, lubricated bearings at both ends of the shafts, adjustments quadrant, and locking devices and shall be constructed of galvanized iron or steel sheet one gauge heavier than the duct in which they are installed. Access doors shall be located at all splitter dampers.

e. Handholes of not less than 6" x 6" shall be provided at all points where access is required. Manholes of not less than 18" x 24" shall be provided at all points where it is necessary to clean or remove parts of equipment. All access doors and handholes shall be rubber gasketed insulated type with

frame and latches.

f. Install access doors at each fire damper, and smoke detector.

g. All joints and seams in ductwork exposed to weather shall be sealed watertight with a suitable non-aging sealer.

3.2 DUCT HANGERS AND SUPPORTS:

a. Duct hangers and supports shall conform to those shown in Tables 4-1 and 4-2 of SMACNA HVAC Ductwork.

3.3 WALL PENETRATIONS:

a. Where ducts pass through non-rated walls and is exposed to view the duct shall be furnished with suitable metal collar.

b. Where ducts pass through one hour fire walls, provide not less than 1/2" clearance between the duct and combustible material. Seal the clearance space with non-combustible material retained, and the duct secured in place by steel collars of a gauge equivalent to that of the duct and fastened to both the duct and the enclosure.

c. Where fire dampers are shown or required, dampers shall be installed per manufacturer's UL listing.

3.4 CLEANING DUCT SYSTEMS:

a. Before fan systems are put in operation, vacuum clean inside of air units, plenums and apparatus housing. Filters are to be installed before moving air through duct systems.

End of Section

SECTION 23 3416

CENTRIFUGAL HVAC FANS

PART 1: GENERAL

1.1 SCOPE:

a. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all the work in this Section.

b. Furnish and install roof mounted exhaust fans as required to provide a complete and satisfactory job.

1.2 SUBMITTALS: Submit the following in accordance with Section 23 0500 – Common Work Results for HVAC:

a. Manufacturer's cuts.

b. Certified capacity ratings.

c. Installation instructions.

d. Operating and Maintenance Instructions.

PART 2: PRODUCTS

2.1 ROOF MOUNTED EXHAUST FANS:

a. Roof exhaust fans shall be of the centrifugal, belt driven or direct driven type. Construction of the fan housing shall be of heavy gauge aluminum mounted upon a rigid support structure which affords minimal resistance to airflow and noise generation. The fan wheel and inlet cone shall be aluminum and of the high performance, centrifugal blower type. Wheels shall overlap the spun inlet venturi for maximum performance. Wheels shall be statically and dynamically balanced to assure smooth and vibration-free operation. Entire drive assembly shall be mounted on vibration isolators.

b. Motor and drives shall be isolated from the exhaust airstream. Air for cooling the motor shall be taken into the motor compartment from a location free from discharge contaminants. Motors shall be of the heavy duty type with permanently lubricated, sealed ball bearings.

c. The entire drive assembly and wheel, as a unit, shall be removable through the support structure without dismantling the fan housing. The wheel shaft shall be mounted in heavy duty, permanently sealed pillow block ball bearings. Belt drives shall be sized for a minimum of 165% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulleys shall be adjustable for final system balancing.

d. All fans shall bear the AMCA Certified Performance Seal for both air and sound performance.

e. Motor. The motor shall be of a standard type that is easily replaceable and may be either sleeve or ball bearing type. Maximum RPM of the motor shall be l750 RPM.

f. Wire Guard. The inlet side of the fan shall be provided with a wire guard which completely surrounds the fan blades.

g. Shutter. Gravity type.

h. Control. The fan shall be controlled as shown on the drawings.

End of Section

SECTION 23 7223

ENERGY RECOVERY MODULES

PART 1: GENERAL

1.1 SCOPE:

a. The provisions of Section 23 0500 apply to all the work in this Section.

b. Furnish and install bolt on energy recovery units indicated or required to provide a complete and satisfactorily system.

1.2 RELATED WORK:

a. Section 23 8119 – Packaged Rooftop Units

b. Section 23 3000 – HVAC Air Distribution

1.3 REFERENCES:

a. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

b. SMACNA - HVAC Duct Construction Standards.

c. ARI 410 - Standard for Forced Circulation Air-Cooling and Air-Heating Coils.

d. ANSI/UL 900 - Test Performance of Air Filter Units.

f. AMCA 301 - Method for Publishing Sound Ratings for Air Moving Devices.

1.4 QUALITY ASSURANCE:

a. Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product offering.

1.5 SUBMITTALS: Submit the following in accordance with Section 23 0500.

a. Catalog cuts.

b. Certified capacity ratings.

c. Installation instructions.

d. Operating and Maintenance Instructions.

1.6 OPERATION AND MAINTENANCE DATA:

a. Submit operation and maintenance data under provisions of Section 23 0500 – Common Work Results for HVAC.

b. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.7 DELIVERY, STORAGE, AND HANDLING:

a. Deliver products to site under provisions of Section 23 0500 – Common Work Results for HVAC on a factory-installed 6" high base rail or shipping skid.

b. Store and protect products under provisions of Section 23 0500 – Common Work Results for HVAC.

c. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.8 ENVIRONMENTAL REQUIREMENTS:

a. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2: PRODUCTS

2.1 CASING - Standard panels shall be 20 gauge galvanized steel. The housing shall be supported by a formed structural base that forms a pan to ensure weather tight construction. Lifting holes shall be provided at the unit base. Units shall have a weatherproof sheet metal roof. Insulation shall be ½" thick closed-cell neoprene for wash down capability and resistance to fungal growth. Dual wall construction is not required with the use of closed cell neoprene insulation. The outdoor air intake opening shall be protected by a galvanized steel sheet metal weather hood and include an automatic shutoff damper with electric operator. The exhaust air discharge shall be covered with a gravity backdraft damper and weather hood. The exterior of the unit shall be coated with an epoxy primer and a polyurethane enamel painting system for added protection. Painting system shall be rated to meet a 750-hour salt spray test. Color matched to Trane Precedent™ Series units.

Note: Fiberglass insulation is acceptable only if dual wall cabinet construction is used, to ensure glass fibers cannot enter the airstreams during operation, or as a result of maintenance activity. Foil-faced glass fiber is not acceptable.

2.2 ACCESS - Access to components shall be provided through large, hinged, tightly sealed and easily removable access panels. Access panels shall be constructed of the same materials as the unit casing and use standard latching hardware. Units with access on multiple sides will need to be coordinated and reviewed by the engineer for acceptable service clearance space. The wheel cassette shall be easily removable from the unit. The roof of the unit shall also be removable for access.

2.3 UNIT CONFIGURATION - The supply air inlet and exhaust air outlet must be oriented on opposite sides of the Energy Recovery System to maximize the separation between the two airstreams in order to minimize the risk of short circuiting exhaust air into the supply air intake. The SP unit is designed to mate up to Trane Precedent downflow or horizontal discharge rooftop package units per manufacturer's selection charts.

2.4 FANS - Fans shall be double width double inlet design with forward curve type wheels. The blades shall be designed for maximum efficiency and quiet operation. Impellers shall be statically and dynamically balanced.

Fans shall be driven by direct drive motors located at the fan inlet or by motors using belts and sheaves. Motors shall be standard NEMA frame with open drip-proof enclosures. V-belt drives shall be designed for a minimum 1.2 service factor.

2.5 TOTAL ENERGY RECOVERY WHEEL – The rotor media must be made of aluminum which is formed into a fluted, honeycomb matrix which is coated to prohibit corrosion; paper, fibrous or plastic media is not acceptable. All surfaces must be coated with a non-migrating zeolite desiccant composite designed to maximize latent recovery while reducing the transfer of airborne contaminants compared to silica gel or oxidized aluminum recovery wheels. The wheel media shall be a permanent component with an estimated 20-year life and not a “throw away” item. The component should be suitable for integration within units incorporating heating sources of all types without damage and designed to accommodate operating conditions up to 180 degrees F.

The recovery wheel product performance must be AHRI certified. Submitted data must be based upon this certified data, meeting or exceeding the temperature and latent efficiencies scheduled. The wheel pressure loss data must not exceed that scheduled for the supply and return airstreams.

The recovery media must have been independently tested by a recognized laboratory to show compliance with UL-900 requirements with regard to smoke generation and combustibility. A full copy of the UL-900 test report must be provided for review with submittals.

The recovery wheel media shall be cleanable with low temperature steam, hot water, or light detergent without degrading the latent recovery.

2.6 Purge Sector - The unit must be available with a purge sector designed to limit cross-contamination of the exhaust airstream concentration when operated under appropriate design conditions.

2.7 Rotor Seals - The rotor shall be supplied with pre-adjusted low leakage hybrid brush seals to separate the two airstreams.

2.8 Rotor Support System - The rotor media must be re-enforced with an aluminum structural spoke system, extruded central hub and shaft sized to limit deflection and to ensure long-term structural integrity.

2.9 Rotor Cassette - The rotor cassette must be designed to limit deflection of the rotor due to air pressure loss and facilitate the easy removal of the rotor from the unit. The sheet metal panels shall be made of galvanized steel to prevent corrosion. The rotor shall be supported by two flange bearings which can be maintained or replaced without the replacement of the rotor.

2.10 Drive System - The rotor must be driven by a reinforced, industrial grade adjustable link belt system. Plastic stretch belts are not acceptable. An A/C gear motor is utilized for constant and variable speed applications.

2.11 FILTERS - The filters shall be 1-inch thick permanent aluminum washable type mounted in the outside air hood and in the return air plenum. The filters shall be listed by Underwriters' Laboratories as Class 2. For units using throw-away type filters, the manufacturer shall provide a minimum of 2 sets of replacements of equal size and depth for future use or provide permanent washable filters.

2.12 AIRFLOW MONITOR - Unit shall include an integral airflow monitoring station with the ability to read both ventilation and exhaust airflow expressed in cubic feet per minute (CFM). Monitor gauge to be flush mounted on unit exterior and watertight. Monitor shall be SEMCO Model AQFlow or Ruskin Model IAQ50 Integral Monitor/Damper, or approved equal. Dirty filter monitors are not an acceptable substitute.

2.13 START UP / BALANCING – Energy Recovery Unit shall be air balanced per the CFM requirements listed in the schedule shown on the drawings. Units provided with a factory-mounted airflow-monitoring device that measure flow in CFM are acceptable with contractor's air balance report. Units not provided with an airflow-monitoring device shall require third party air balance report to the building owner. Third party air balance company shall have been in business a minimum of 5 years and be NEBB certified. All belts, drives and dampers shall be adjusted as required to meet specified airflow performance.

2.14 FROST THRESHOLD – Manufacturers will be required to provide wheel frost threshold data. Any units not meeting minimum scheduled wheel frost threshold will be required to provide wheel frost protection in the form of preheat coils.

2.15 ELECTRICAL – The Recovery Units shall require a single point 60-cycle power connection. See schedule for voltage and phase requirements. The electrical panel shall consist of individual motor contactors, short circuit and overload protection and control power transformer. The NEMA 3R electrical panel shall be mounted on the unit exterior for ease of access. Unit shall be ETL listed and labeled.

2.16 WARRANTY – manufacturer warrants to Buyer that for a period of eighteen months from the date of shipment. The manufacturer warrants the goods to be delivered to Buyer to be in all material respects free from defects in material and workmanship when used in a proper and normal manner. Should any failure to conform to the above appear within eighteen months after the date of shipment by the manufacturer (the "Limited Warranty Period"), the manufacturer agrees upon prompt notification thereof during the Limited Warranty Period and confirmation to manufacturer's satisfaction that the goods have been stored, installed, operated and maintained properly and in accordance with standard industry practice, to correct the non-conformity at its option either by repairing any defective part or parts or by making available at manufacturer's plant a repaired or replacement part.

Note: All components shall be warranted by energy recovery unit manufacturer. Separate component warranties are not acceptable.

End of Section

SECTION 23 8119

PACKAGED ROOFTOP UNITS

PART 1: GENERAL

1.1 SCOPE:

a. The provisions of Section 23 0500 – Common Work Results for HVAC, apply to all work in this Section.

b. Furnish and install packaged rooftop units as shown or required to provide a complete and satisfactory job.

1.2 RELATED WORK:

a. Section 23 0700 – HVAC Insulation

b. Section 23 3000 – HVAC Air Distribution

1.3 REFERENCES:

a. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

b. SMACNA - HVAC Duct Construction Standards.

c. ARI 410 - Standard for Forced Circulation Air-Cooling and Air-Heating Coils.

d. ANSI/UL 900 - Test Performance of Air Filter Units.

f. AMCA 301 - Method for Publishing Sound Ratings for Air Moving Devices.

1.4 QUALITY ASSURANCE:

a. Rooftop Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product offering.

1.5 SUBMITTALS:

a. Submit as-built drawings and product data under provisions of Section 23 0500 – Common Work Results for HVAC.

b. As-built drawings shall show unit configuration in direction of airflow, and shall indicate assembly and unit dimensions.

c. Product data shall indicate dimensions, weights, capacities, fan performance, motor electrical characteristics, and finishes of materials.

d. Submit product data of filter sizes and quantities, filter performance, and filter frames.

e. Submit manufacturer's installation instructions under provisions of Section 23 0500 – Common Work Results for HVAC.

1.6 OPERATION AND MAINTENANCE DATA:

a. Submit operation and maintenance data under provisions of Section 23 0500 – Common Work Results for HVAC.

b. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.7 DELIVERY, STORAGE, AND HANDLING:

a. Deliver products to site under provisions of Section 23 0500 – Common Work Results for HVAC on a factory-installed 6" high base rail or shipping skid.

b. Store and protect products under provisions of Section 23 0500 – Common Work Results for HVAC.

c. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.8 ENVIRONMENTAL REQUIREMENTS:

a. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.9 EXTRA STOCK:

a. Provide one extra set of renewable media MERV 13 filters.

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

a. Trane

b. York

c. Carrier

2.2 GENERAL:

a. The units shall be convertible airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for units with microprocessor controls. Operating range for units with electromechanical controls shall be between 115°F and 40°F. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be UL listed and labeled, classified in accordance for Central Cooling Air Conditioners.

2.3 CASING:

a. Unit casing shall be constructed of zinc coated, heavy gauge galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit.

b. Service panels shall have lifting handles and be removed and reinstalled by removing two

fasteners while providing a water and airtight seal. All exposed vertical panels and top covers in the indoor air section shall be insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material. The base of the unit shall be insulated with 1/8 inch, foil-faced, closed-cell insulation. All insulation edges shall be either captured or sealed. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8 inch high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting, with forklift capabilities on three sides of the unit.

c. The top cover shall be one-piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

2.4 COMPRESSORS:

a. All units shall have direct-drive and hermetic type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors.

b. Crankcase heaters shall be included.

2.5 FILTERS:

a. Filter modules shall have filter racks, at least one access door for filter removal, and filter block-offs to prevent air bypass around filters. The modules shall be supplied with MERV 13 filters.

2.6 INDOOR FANS:

a. YHC120 unit shall be equipped with a direct drive plenum fan design. Plenum fan design shall include a backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor.

b. All plenum fan designs will have a variable speed adjustment potentiometer located in the control box. 3-5 ton units (standard efficiency 3-phase or high efficiency 3-phase with optional motor) are belt driven, FC centrifugal fans with adjustable motor sheaves. 3-5 ton units (1-phase or high efficiency 3-phase) have multispeed, direct drive motors. All 6-8½ ton units (standard efficiency) shall have belt drive motors with an adjustable idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. All 10 tons and 7½-8½ (high efficiency) to have variable speed direct drive motors. All indoor fan motors shall be thermally protected and meet the U.S. Energy Policy Act of 1992 (EPACT).

2.7 OUTDOOR FANS:

a. The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position.
The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

2.8 SINGLE ZONE VAV:

a. Single zone VAV units to match fan speed with cooling and heating loads exactly, regardless of the operating condition. Operation algorithms are to meet or exceed ASHRAE 90.1- 2010.

b. Single zone VAV is to be fully integrated into the control system. Unit shall have factory-installed, wired, and tested system controllers. All control modules, logic and sensors are to be factory installed.

2.9 COILS:

a. Coils to be internally finned, 5/16" copper tubes mechanically bonded to a configured aluminum plate fins.

Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 600 psig. The assembled unit shall be leak tested to 465 psig.

A removable, reversible, double-sloped condensate drain pan with through the base condensate drain is to be provided.

2.10 CONTROLS:

a. Unit shall be completely factory-wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Unit shall provide an external location for mounting a fused disconnect device. Microprocessor controls provide for volt control functions. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm is to maintain accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized Microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

b. Units shall be provided with a Generic Building Automation System (GBAS) terminal strip that will accept contact closures from a DDC thermostat provided by the controls contractor. On a call for cooling or heating, the unit's onboard controller will control compressors, economizer, gas heat and/or fan speed as called for by sequence of operation.

2.11 HIGH PRESSURE SAFETY:

a. All units include High Pressure Cutout as standard.

2.12 PHASE MONITOR:

Phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor is to be equipped with an LED that provides an ON or FAULT indicator. There are to be no field adjustments required. The module shall automatically reset from a fault condition.

2.13 REFRIGERANT CIRCUITS:

a. Each refrigerant circuit is to have thermal expansion valve as standard. Service pressure ports and refrigerant line filter driers are to be factory-installed as standard.

b. Hot gas reheat mode shall mix a portion of the hot gas from the discharge of the compressor with the hot liquid refrigerant leaving the condenser coil to create a two--phase heat transfer in the system, resulting in a neutral leaving- air temperature when cooling is not called for but humidity in the space is higher than set point.

2.14 GAS HEATING SECTION:

The heating section shall have a progressive tubular heat exchanger design using stainless steel burners and corrosion resistant steel throughout. An induced draft combustion blower shall be used to pull the combustion products through the firing tubes. The heater shall use a direct spark ignition (DSI) system. On initial call for heat, the combustion blower shall purge the heat exchanger for 20 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat/zone sensor. Units shall be suitable for use with
natural gas.

2.15 SINGLE ZONE VARIABLE AIR VOLUME CONTROL SEQUENCE OF OPERATION:

a. General Standby Mode:During normal occupied periods, if the supply fan is operating under no load conditions or due to a ventilation request, the supply fan will operate at 50% of the user selected, application specific, maximum airflow. The unit controls will be compatible with BACnet Building Automation System communication interfaces.

b. Cooling Operation: During Cooling operation, the control will monitor the Space Temperature and Space Cooling setpoint and with a PI control algorithm determine if active cooling capacity is required. As the Space Temperature deviates from the Space Cooling Setpoint, the unit controller will calculate an active Discharge Air Cooling setpoint that the economizer (if installed) and compressor outputs will be controlled to meet. This active Discharge Air Cooling setpoint will be calculated between the Space Cooling setpoint and a user adjustable minimum (65F Default for Single Zone Variable Air Volume Control). Once the control determines that a discharge air temperature equal to the user selected minimum (65F Default) is required to meet the space cooling demand, if the space demand continues to increase, the supply fan speed will be allowed to increase above its minimum speed proportionally to meet the additional demand.

c. Economizer Operation: Under the Default Operation, as described above, the supply fan speed will remain at minimum speed, as determined by the active cooling stages, until the space demand requires an increase in supply airflow. The customer will have the ability to choose to allow the supply fan speed to increase when the economizer is enthalpy enabled in order to realize the maximum cooling capacity of the economizer, prior to energizing compressor outputs, when the space requires active cooling capacity. All cooling capacity demand decisions will function as described above with the exception of the supply fan speed when the unit has an active cooling demand and the economizer is enthalpy enabled.

d. Heating Operation: During Heating operation, the control will monitor the Space Temperature and Space Heating setpoint and with a PI control algorithm determine if active heating capacity is required. As the Space Temperature deviates from the Space Heating Setpoint, the unit controller will increase the supply airflow up to the user selected, application specific, maximum airflow and begin to stage heating outputs (gas or electric) to meet the space demand.
The customer will also have the ability to enable Supply Air Tempering control which will allow the unit to bring on one stage of heating when the discharge air temperature falls below the Space Heating Setpoint - 10°F and the unit is operating in a minimum ventilation state with the supply fan running (not actively heating or cooling). The supply fan output will increase to the user selected, application specific, maximum airflow during Supply Air Tempering operation.

PART 3: EXECUTION:

3.1 INSTALLATION:

a. Units are to be installed according to the manufacturer’s installation. Unit start up shall be per manufacturer’s instructions and shall be conducted by a factory-trained technician.

End of Section

SECTION 25 5000

INTEGRATED AUTOMATIC FACILITY CONTROLS

PART 1 – GENERAL

1.1 Related Documents

a. All work of this Division shall be coordinated and provided by the single Central Control and Monitoring System (CCMS) Contractor.

b. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.

c. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

1.2 Scope of Work

a. This section includes the controls, instrumentation and associated piping and wiring required to make the mechanical systems provided under Division 23 perform as described in these specifications and as shown. Provide a complete system of automatic temperature control of the direct digital type. The system shall be complete in all respects including all labor, materials, equipment, and service necessary, and shall be installed by personnel in the direct employ of the manufacturer. Provide a distributed process network control system complete with all necessary hardware and software including all programming. The new DDC systems for the new Soccer Building shall be compatible with the existing USC campus wide control system network in all respects. The existing control system network is Johnson Controls Metasys.

b. Utilize the existing CMMS server for the purpose of providing a location for archiving system configuration data, graphics and historical data such as trend data and operator transactions.

c. Provide a complete and operational Central Control and Monitoring System (CCMS) including all devices and software necessary to perform the functions herein described or indicated on the drawings.

d. The CMMS shall be a Web based system communicating over the building owners Local Area Network (LAN). Contractor shall be responsible for coordination with the owner's IT staff to ensure that the CMMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN. TCP/IP connections and addresses shall be provided by the owner for connection of supervisory panels to the USC network..

e. The primary desktop and laptop interface will be via a standard Web Browser such as Internet Explorer or Netscape. CMMS contractor shall provide software license(s) for CMMS WEB access for a minimum of twenty concurrent users.

f. The primary focus of the Central Control and Monitoring System (CCMS) will be to monitor and control the new HVAC system components, air handling units, fans, heat exchangers, coils, valves, pumps, variable speed drives, etc. The system shall be expandable to serve future equipment, systems, and auxiliary field devices.

g. CCMS contactor shall provide all DDC panels, power supplies, wiring, conduit, solenoid valves, relays, differential pressure transmitters, differential pressure switches, RTDS, pressure sensors, etc. necessary for a complete and operable automatic control system and DDC field panels and connecting LAN.

h. The systems engineering phase shall include the selection and integration of components into a complete system which will meet the performance and prescriptive requirements of the Contract, together with drawings, specifications, descriptions of operation, diagrams including system architecture and other materials listed under "Submittals" paragraph of this Section. The successful contractor shall be responsible for all systems engineering.

1.3 Quality Assurance

a. Quality assurance for automatic control systems includes a multi-step program consisting of a pre-qualification procedure for manufacturer and installation specialist; a system engineering, products and shop drawing phase; installation; testing and adjusting; reporting; commissioning testing and verifications; operating instruction and training; and the submission of maintenance and operating manuals.

b. CMMS Contractor

1. The Central Control and Monitoring System (CMMS) herein specified shall be fully integrated and installed as a complete package by the Central Control and Monitoring System contractor. The System shall include all wiring, piping, installation supervision, calibration, adjustments, and checkout necessary for a complete and fully operational system.

2. The CMMS Contractor shall be a factory owned branch office that is regularly engaged in the engineering, programming, installation and service of CMMSs of similar size and complexity. Bids by wholesalers, mechanical contractors, franchised dealers, applied partners or any other firm whose principal business is not that of manufacturing and installing automatic temperature control systems shall not be acceptable.

3. The CMMS Contractor shall have a minimum of ten years experience with the complete, turnkey installation of CMMSs of similar size and technical complexity.

4. The CMMS shall be complete in all respects and shall be provided, installed and commissioned by the CMMS equipment manufacturer. Equipment manufacturer shall be responsible for and warrant the proper installation and operation of the CMMS and control system equipment.

5. The following CMMS contractors are approved to provide and install the CMMS for this project subject to their ability to meet all requirements of this specification:

Johnson Controls, Inc
14 Woodcross Drive
Columbia, SC 29212

6. Bid approval does not imply nor suggest compliance of specification requirements.

c. CMMS Products Manufacturer:

1. The CMMS architecture shall consist of the products of a manufacturer regularly engaged in the production of CMMSs, and shall be the manufacturer’s latest standard of design. Controllers and DDC (Direct Digital Control) system components shall be current production products.

2. All other equipment shall be the products of the CMMS manufacturers or of an approved manufacturer regularly engaged in production of specialized CMMS materials or

equipment.

3. Following is a list of acceptable CMMS products manufacturers:

Johnson Controls, Inc
14 Woodcross Drive
Columbia, SC 29212

4. Bid approval does not imply nor suggest compliance of specification requirements.

1.4 Work Included and Interface Requirements

a. Installation of Central Control and Monitoring System (CMMS)

1. The CMMS contractor shall provide all necessary hardware and software to integrate the new control system with the existing USC campus CMMS. Integration means the ability to monitor, override, change set points, and provide real-time bi-directional dynamic data exchange between the new control system and the existing CMMS hardware and software.

2. The existing USC campus CMMS is a Johnson Controls Metasys system. The CMMS is comprised of multiple supervisory controllers, monitoring and communicating with various building control systems over the USC campus Ethernet LAN system. The new building control system will be connected to, and communicate with, the existing campus CMMS server via the USC campus Ethernet LAN

3. All new control points, monitoring points and software points shall be added to the existing USC CMMS database and shall be available for monitoring and adjustment at any computer, with current copy of Microsoft Internet Explorer software (Release 6.0 or later), that is connected to the USC LAN.

4. All new building software and databases shall be archived on the hard drive at the USC CMMS server. In the event that any building controller should lose its program that controller's archived software program shall be downloaded across the CMMS network from the CMMS server to the respective building controller.

5. The CMMS contractor will provide all necessary hardware, software, and labor to allow communication with all any computer, with current copy of Microsoft Internet Explorer (Release 6.0 or later), that is connected to the USC LAN.

6. Integrity of the existing CMMS shall be maintained during installation.

7. The new building control system shall be compatible in every respect with existing Metasys CMMS hardware and software. All new controllers shall be compatible with Metasys database and Metasys software development tools

1.5 Submittals

a. Shop Drawings, Product Data, and Samples

1. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.

2. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.

3. The CCMS Contractor shall correct any errors or omissions noted in the first review.

4. At a minimum, submit the following:

A. CCMS network architecture diagrams including all nodes and interconnections.

B. Systems schematics, sequences and flow diagrams.

C. Points schedule for each point in the CCMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.

D. Samples of Graphic Display screen types and associated menus.

E. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.

F. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.

G. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.

H. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address

I. Details of all CCMS interfaces and connections to the work of other trades.

J. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 Record Documentation

a. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the CCMS provided:

A. Table of contents.

B. As-built system record drawings. Computer Aided Drawings (CAD)

record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.

C. Manufacturers product data sheets or catalog pages for all products including software.

D. System Operator's manuals.

E. Archive copy of all site-specific databases and sequences.

F. CCMS network diagrams.

G. Interfaces to all third-party products and work by other trades.

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 Warranty

a. Standard Material and Labor Warranty:

1. Provide a one-year labor and material warranty on the CCMS.

2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the CCMS Contractor at the cost of the CCMS Contractor.

3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during CCMS Contractor's normal business hours.

2. PART 2 – PRODUCTS

2.1 General Description

a. The Central Control and Monitoring System (CCMS) shall use an open architecture. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

b. The Central Control and Monitoring System shall consist of the following:

1. Standalone Network Automation Engine(s)

2. Field Equipment Controller(s)

3. Networkable DDC thermostats

4. Input/Output Module(s)

5. Local Display Device(s)

6. Distributed User Interface(s)

7. Network processing, data storage and communications equipment

8. Other components required for a complete and working CCMS

c. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

d. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2.2 CCMS Architecture

a. Automation Network

1. The CCMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Utilize existing application and data server as required for systems operation.

2. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.

3. Network Automation Engines (NAE) shall reside on the automation network.

4. The automation network will be compatible with other campus-wide networks. Where indicated, the automation network shall be connected to the campus network and share resources with it by way of standard networking devices and practices.

b. Control Network

1. Network Automation Engines shall provide supervisory control over the control network.

2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.

3. DDC Controllers shall reside on the control network

4. Wireless communication between DDC controllers is acceptable. All sensors shall be wired.

2.3 Network Automation Engines (NAE)

a. Network Automation Engine (NAE)

1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.

2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.

3. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control

processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.

4. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.

5. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

6. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

A. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.

B. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

2.4 DDC System Controllers

a. Field Equipment Controller (FEC)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.

2. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.

3. The FEC shall be assembled in a plenum-rated housing with flammability rated to UL94-5VB.

4. The FEC shall include a removable base to allow pre-wiring without the controller.

5. The FEC shall accommodate the direct wiring of analog and binary I/O field points.

6. The FEC shall support the following types of inputs and outputs:

A. Universal Inputs - shall be configured to monitor any of the following:
1 Analog Input, Voltage Mode

2 Analog Input, Current Mode

3 Analog Input, Resistive Mode

4 Binary Input, Dry Contact Maintained Mode

5 Binary Input, Pulse Counter Mode

B. Binary Inputs - shall be configured to monitor either of the following:

1 Dry Contact Maintained Mode

2 Pulse Counter Mode

C. Analog Outputs - shall be configured to output either of the following

1 Analog Output, Voltage Mode

2 Analog Output, current Mode

D. Binary Outputs - shall output the following:

1 24 VAC Triac

E. Configurable Outputs - shall be capable of the following:

1 Analog Output, Voltage Mode

2 Binary Output Mode

7. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).

A. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.

B. The FC Bus shall support communications between the FECs and the NAE.

C. The FC Bus shall support a minimum of 100 IOMs and FEC in any combination.

D. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.

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8. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).

A. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.

B. The SA Bus shall support a minimum of 10 devices per trunk.

C. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.

9. The FEC shall support, but not be limited to, the following:

A. Hot water, chilled water/central plant applications

B. Built-up air handling units for special applications

C. Terminal units

D. Special programs as required for systems control

2.5 Field Devices

a. Input/Output Module (IOM)

1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the FEC.

2. The IOM shall communicate with the FEC over either the FC Bus or the SA Bus using BACnet Standard protocol SSPC-135, Clause 9.

b. Networked Thermostat (TEC)

1. The Networked Thermostats shall be capable of controlling the following:

A. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine.

2. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.

A. Two line, 8 character backlit display

B. LED indicators for Fan, Heat, and Cool status

C. Five (5) User Interface Keys

1 Mode
2 Fan
3 Override
4 Degrees C/F
5 Up/Down

3. The Networked Thermostats shall provide the flexibility to support the following inputs:

A. Integral Indoor Air Temperature Sensor

B. Duct Mount Air Temperature Sensor

C. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.

D. Two configurable binary inputs

4. The Networked Thermostats shall provide the flexibility to support the following outputs:

A. Three Speed Fan Control

B. On/Off Control

C. Floating Control

D. Proportional (0 to 10V) Control

2.6 Input Devices

a. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

b. Temperature Sensors

1. General Requirements:

A. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.

B. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.

C. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

2. Room Temperature Sensors

A. Room sensors shall be constructed for either surface or wall box mounting.

B. Room sensors shall have the following options when specified:

1 Set point reset slide switch providing a +3 degree (adjustable) range.

2 Individual heating/cooling set point slide switches.

3 A momentary override request push button for activation of after-hours operation.

3. Outside Air Sensors

A. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.

B. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.

C. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

4. Duct Mount Sensors

A. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.

B. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.

C. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

c. Smoke Detectors

1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 26, Fire Alarm System.

d. Status and Safety Switches

1. General Requirements

A Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the CCMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

A. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

B. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

C. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

D. Acceptable manufacturers: Veris Industries

2.7 Output Devices

a. Actuators

1. General Requirements

A. Damper and valve actuators shall be electronic. Controls submittals shall indicate actuator fail position as normally open or closed.

2. Electronic Damper Actuators

A. Electronic damper actuators shall be direct shaft mount.

B. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.

C. Modulating actuators shall accept 24 VAC or VDC power supply,

consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as “quick acting,” shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.

e. Acceptable manufacturers: Johnson Controls, Mamac.

B. Control Relays

1. Control Pilot Relays

A. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.

B. Mounting Bases shall be snap-mount.

C. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.

D. Contacts shall be rated for 10 amps at 120VAC.

E. Relays shall have an integral indicator light and check button.

F. Acceptable manufacturers: Johnson Controls, Lectro

2.8 Miscellaneous Devices

a. Local Control Panels

1. All control panels shall be factory constructed, incorporating the CCMS manufacturer’s standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.

2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.

3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.

4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.

5. All wiring shall be neatly installed in plastic trays or tie-wrapped.

6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

b. Thermostats

1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

3. PART 3 – PERFORMANCE / EXECUTION

3.1 CCMS Specific Requirements

a. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.

2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection. .

b. Actuation / Control Type

1. Primary Equipment

A. Controls shall be provided by equipment manufacturer as specified herein.

B. All damper and valve actuation shall be electric.

2. Air Handling Equipment

A. All air handers shall be controlled with a HVAC-DDC Controller

B. All damper and valve actuation shall be electric.

3. Terminal Equipment:

A. Terminal Units (VAV, FPVAV, FCU etc.) shall have electric damper and valve actuation.

B. All Terminal Units shall be controlled with HVAC-DDC Controller)

3.2 Installation Practices

a. CCMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Central Control and Monitoring System, as herein specified, shall be provided by the CCMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.

2. All CCMS wiring materials and installation methods shall comply with CCMS manufacturer recommendations.

3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the CCMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the CCMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

4. Class 2 Wiring

A. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.

B. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

b. CCMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size to be 1/2".

2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

c. Penetrations

1. Provide fire stopping for all penetrations used by dedicated CCMS conduits and raceways.

2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

d. CCMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

e. CCMS Panel Installation

1. The CCMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.

2. The CCMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

f. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation

2. Locate components of the CCMS in accessible local control panels wherever possible.

g. HVAC Input Devices – Genera1

1. All Input devices shall be installed per the manufacturer recommendation

2. Locate components of the CCMS in accessible local control panels wherever possible.

3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.

5. Outside Air Sensors

A. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.

B. Sensors shall be installed with a rain proof, perforated cover.

6. Water Differential Pressure Sensors

A. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.

B. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.

C. The transmitters shall be installed in an accessible location wherever possible.

7. Medium to High Differential Water Pressure Applications (Over 21" w.c.):

A. Air bleed units, bypass valves and compression fittings shall be provided.

8. Building Differential Air Pressure Applications (-1" to +1" w.c.):

A. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.

B. The interior tip shall be inconspicuous and located as shown on the drawings.

9. Duct Temperature Sensors:

A. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

B. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.

C. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.

D. The sensor shall be mounted to suitable supports using factory approved element holders.

10. Space Sensors:

A. Shall be mounted per ADA requirements.

B. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.

11. Low Temperature Limit Switches:

A. Install on the discharge side of the first water or steam coil in the air stream.

B. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.

C. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

12. Air Differential Pressure Status Switches:

A. Install with static pressure tips, tubing, fittings, and air filter.

13. Water Differential Pressure Status Switches:

A. Install with shut off valves for isolation.

h. HVAC Output Devices

1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers,

airflow stations, pressure wells, etc.

2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.

4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.

5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Central Control and Monitoring System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.3 Training

a. The CCMS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the CCMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

3.4 Commissioning

a. Fully commission all aspects of the Central Control and Monitoring System work.

b. Acceptance Check Sheet

1. Prepare a check sheet that includes all points for all functions of the CCMS as indicated on the point list included in this specification.

2. Submit the check sheet to the Engineer for approval

3. The Engineer will use the check sheet as the basis for acceptance with the CCMS Contractor.

c. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

3.5 SEQUENCE OF OPERATION

a. GENERAL

1. Power - Fail Restart: In the event of a power failure the FMS computer will analyze the status of all controlled equipment and compare it with normal occupancy scheduling. The equipment will then be started or stopped as necessary to prevent all equipment from coming on at the same time.

2. Optimal Start:

A All scheduled HVAC equipment will be started based on an optimal start feature that will calculate the approximate time the unit will have to be started prior to scheduled start time in order for the space temperature to be at set point at schedules occupancy.

B Once space temperatures reach occupied set point O.A. dampers will be modulated open. Whenever the unit goes in the unoccupied mode the O.A. damper will be closed.

3. Night High Limit and Night Low Limit:

A During unoccupied periods scheduled HVAC equipment will be energized whenever space temperature drops below a night low limit set point of 65 degrees(adjustable) or a night high limit of 85 degrees(adj).

b. RTU1-11 [Single Zone Rooftop Units Unit]

1. Start/Stop:

A. The unit will be started and stopped based on a time of day schedule from the CCMS.

B. When the unit goes into the occupied mode and is to be started, the outdoor air damper will be driven open and driven closed when in unoccupied mode.

2. Safeties:

A. Duct smoke detector will shut the supply fan off whenever products of combustion are sensed. The smoke detector will be provided and wired back to fire alarm system by division 16 and interlocked with the fan starter under division 15.

3. Temperature Control:

A. RTUs will be factory supplied with a Generic Building Automation System (GBAS) terminal strip that will accept contact closures from a DDC thermostat provided under this section. On a call for cooling or heating the unit's onboard controller will control compressors, economizer, gas heat and/or fan speed as called for by the sequence of operation detailed under the packaged rooftop unit specification.

4. Discharge Air:

A. Provide discharge air temperature sensor for monitoring only

C. EF1-4 [Exhaust Fans]

1. Start/Stop:

A. The unit will be started and stopped based on a time of day schedule from the CCMS.

D. VAV DAMPER

A. Building Automation System Interface: The Building Automation System (BAS) shall send the controller Occupied and Unoccupied commands. The BAS may also send a Heat/Cool mode, priority shutdown commands, space temperature and/or space temperature setpoint. If communication is lost with the BAS, the VAV controller shall operate using its local setpoints.

B. Occupancy Mode: The occupancy mode shall be communicated or hardwired to the VAV via a binary input. Valid Occupancy modes for the VAV shall be:

C. Occupied: Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode the VAV shall maintain the space temperature at the active occupied heating or cooling setpoint.

D. Unoccupied: Normal operating mode for unoccupied spaces or nighttime operation. When the unit is in unoccupied mode the VAV controller shall maintain the space temperature at the stored unoccupied heating or cooling setpoint regardless of the presence of a hardwired or communicated setpoint. When the space temperature exceeds the active unoccupied setpoint the VAV shall modulate fully closed.

E. Occupied Bypass: Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (adj.). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall operate in occupied mode.

F. Heat/Cool Mode: The Heat/Cool mode shall be set by a communicated value or automatically by the VAV. In standalone or auto mode the VAV shall compare the primary air temperature with the configured auto changeover setpoint to determine if the air is "hot" or "cold". Heating mode shall command the VAV to heat only; it implies the primary air temperature is hot. Cooling mode shall command the VAV to cool only; it implies the primary air temperature is cold.

G. Heat/Cool Setpoint: The space temperature setpoint shall be determined either by a local (e.g., thumbwheel) setpoint, the VAV default setpoint or a communicated value. The VAV shall use the locally stored default setpoints when neither a local setpoint nor communicated setpoint is present. If both a local setpoint and communicated setpoint exist, the VAV shall use the communicated value.

H. Cooling Mode: When the unit is in cooling mode, the VAV controller shall maintain the space temperature at the active cooling setpoint by modulating the airflow between the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint. Based on the VAV controller occupancy mode,The VAV shall use the measured space temperature and the active cooling setpoint to determine the requested cooling capacity of the unit. The outputs will be controlled based on the unit configuration and the requested cooling capacity.

I. Space Sensor Failure: If there is a fault with the operation of the zone sensor an alarm shall be annunciated at the BAS. Space sensor failure shall cause the VAV to drive the damper to minimum air flow if the VAV is in the occupied mode, or drive it closed if the VAV is in the unoccupied mode.

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All State and Local Codes and any other listed codes or standards referenced in the drawings or specifications are hereby imposed on a general basis for all electrical work.

1.2 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Common electrical installation requirements.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

1.4 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate electrical testing of electrical, mechanical, plumbing, fire protection and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NFPA 70.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

I. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.5 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 26 0500

SECTION 26 0503

EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:
1. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
2. Section 260533 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Prior to ordering electrical gear, compare to electrical requirements listed on electrical drawings for each piece of equipment. Notify architect / engineer immediately of any changes.

D. Determine connection locations and requirements.

E. Sequence rough-in of electrical connections to coordinate with installation of equipment.

F. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.

B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

3.3 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.4 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 26 0503

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable, wiring connectors and connections.

B. Related Sections:
1. Section 260553 - Identification for Electrical Systems: Product requirements for wire identification.
2. Section 312317 - Trenching: Execution requirements for trenching required by this section.
3. Section 312323 - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.
2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

B. Underwriters Laboratories, Inc.:
1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
1. Solid conductor for branch circuits 10 AWG and smaller.
2. Stranded conductors for control circuits.
3. Conductor not smaller than 12 AWG for power and lighting circuits.
4. Conductor not smaller than 14 AWG for control circuits.
5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.

B. Wiring Methods: Provide the following wiring methods:
1. Use only building wire, Type THHN/THWN insulation, in raceway unless specifically noted otherwise.
2. Type MC Cable shall not be allowed without written permission from engineer.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data for the following:
1. Wire
2. Splice Kits
3. Waterproof Wire Connectors

C. Test Reports: Indicate procedures and values obtained.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Conform to requirements of NFPA 70.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to work. Coordinate dimensions with architectural, structural, and civil drawings. Electrical Drawings are diagrammatic only and shall not be scaled.

1.9 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 ft of length shown.

PART 2 PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Southwire
2. American Insulated Wire Corp.
3. Colonial Wire

4. General Cable Co.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

D. Insulation Voltage Rating: 600 volts.

2.2 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify wire and cable under provisions of Section 260553. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:
1. Pull conductors into raceway at same time.
2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.

4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
7. Polaris type splice kits will not be accepted.

F. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

G. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

H. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

I. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

A. General:
1. For wire sizes 10 AWG and smaller, install wire with insulation colors as designated below.
2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:

B. 120/208-volt, 3 phase system:
Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - White

480/277-volt, 3 phase systems:
Phase A - Orange
Phase B - Brown
Phase C - Yellow
Neutral - Gray

C. Ground Conductors:
1. For 6 AWG and smaller: Green.
2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.
3. For isolated grounding conductors: Green with a yellow stripe.

3.5 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 26 0519

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

B. Related Sections:
1. Section 032000 - Concrete Reinforcing: Bonding or welding bars when reinforcing steel is used for electrodes.
2. Section 096900 - Access Flooring: Grounding systems for access flooring.
3. Section 264100 - Facility Lightning Protection: Grounding of lightning protection system.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.
2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Rod electrode.

1.4 DESIGN REQUIREMENTS

A. Construct and test grounding systems for access flooring systems on conductive floors accordance with IEEE 1100. Refer to Section 096900

1.5 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms maximum.

1.6 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.9 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
1. Erico, Inc.
2. O-Z Gedney Co.
3. Thomas & Betts, Electrical.

B. Product Description:
1. Material: Copper-clad steel.
2. Diameter: 3/4 inch (19 mm).
3. Length: 10 feet (3.0 m).

C. Connector: Connector for exothermic welded connection or U-bolt clamp.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 3/0 AWG.

C. Grounding Electrode Conductor: Copper conductor insulated.

D. Bonding Conductor: Copper conductor bare.

2.3 MECHANICAL CONNECTORS

A. Manufacturers:
1. Erico, Inc.
2. ILSCO Corporation
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Copperweld, Inc..
2. ILSCO Corporation.
3. O-Z Gedney Co..
4. Thomas & Betts, Electrical.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove surface contaminants at connection points.

3.3 INSTALLATION

A. Install in accordance with IEEE 142 and 1100.

B. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

C. Install grounding and bonding conductors concealed from view.

D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings. Electrically bond steel together.

E. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid.

F. Install isolated grounding conductor for circuits supplying personal computers in accordance with IEEE 1100.

G. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

H. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

I. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.

J. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

K. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

L. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements and 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 26 0526

SECTION 26 0529

ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Seismic restraints for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IBC: International Building Code.

C. IMC: Intermediate metal conduit.

D. RMC: Rigid metal conduit.

E. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent. This site is a Seismic ‘C’ Classification.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Channel Dimensions: Selected for structural loading.

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 SEISMIC-RESTRAINT COMPONENTS

A. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

B. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps using spring friction action for retention in support channel.

C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Cables and raceways using support wire shall comply with requirements of article 300.11 of 2011 NEC.

D. Luminaries shall be supported as required by article 410.30 and 410.36 of 2011 NEC.

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   1. To Wood: Fasten with lag screws or through bolts.
   2. To Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
   5. To Light Steel: Sheet metal screws.
   6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

A. Restraint Cables: Provide #12 slack steel cables on all recessed light fixtures. Provide two cables on all 2'x4' recessed fixtures attached from structure to diagonally opposite corners of fixtures. Provide one cable on each smaller fixture.

B. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

END OF SECTION 26 0529

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:
1. Section 260503 - Equipment Wiring Connections.
2. Section 260526 - Grounding and Bonding for Electrical Systems.
3. Section 260529 - Hangers and Supports for Electrical Systems.
4. Section 260534 - Floor Boxes for Electrical Systems.
5. Section 260536 - Cable Trays for Electrical Systems.
6. Section 260553 - Identification for Electrical Systems.
7. Section 262726 - Wiring Devices.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground: Provide thin-wall nonmetallic conduit (schedule 40 PVC) with rigid long-sweep 90-degree elbows unless specifically noted otherwise. Provide cast metal boxes or nonmetallic handhole.

C. In or Under Slab on Grade: Provide thin-wall nonmetallic conduit (schedule 40 PVC). Provide cast or nonmetallic metal boxes.

D. Outdoor Locations, Above Grade: Provide galvanized rigid steel or aluminum conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. In Slab Above Grade: Provide thickwall nonmetallic conduit. Provide cast or nonmetallic boxes.

F. Interior Wet and Damp Locations: Provide galvanized rigid steel or aluminum conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

H. Exposed Dry Locations in unfinished spaces: Provide rigid steel or intermediate metal conduit where subject to damage (see below for defined locations that are subject to damage), electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
   1. Spaces defined as subject to physical damage are as follows:
      a. Mechanical Rooms below 10' above finished floor.
      b. Loading Docks.
      c. Any area with forklift traffic.

I. Exposed Dry Locations in finished spaces (existing conditions only): Provide wiremold (or panduit, or prior approved equal) surface metal raceway. Provide surface metal boxes by same company as raceway. For Communications System, provide deep surface metal boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch (19 mm) unless otherwise specified.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for the following:

1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Flexible nonmetallic conduit.
5. Nonmetallic tubing.
6. Conduit bodies.
7. Surface raceway.
8. Wireway.
9. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents:
1. Record actual routing of conduits larger than 2 inch (DN50).
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed below are basis of design, or can provide products equal to basis of design.
1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Rigid Aluminum Conduit: ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.3 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil (0.05 mm) thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked aluminum construction with PVC jacket.

B. Fittings: NEMA FB 1.

2.6 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.

C. All EMT conduit shall be Anodized with the following color coating:
1. Emergency Life Safety Power: Yellow
2. Emergency Critical Power: Orange
3. HVAC Equipment Power: Green
4. Normal Power: Silver
5. Fire Alarm System: Red
6. Communications Systems: Black

2.7 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.8 NONMETALLIC TUBING

A. Product Description: NEMA TC 2.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.9 SURFACE METAL RACEWAY

A. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

B. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories and as required to provide a complete system, finish to match raceway.

2.10 SURFACE NONMETAL RACEWAY

A. Product Description: Nonmetallic channel with fitted cover, suitable for use as surface raceway.

B. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories and as required to provide a complete system, finish to match raceway.

2.11 WIREWAY

A. Product Description: General purpose for interior locations, and Raintight type for exterior locations wireway.

B. Cover: Hinged cover.

C. Finish: Rust inhibiting primer coating with gray enamel finish.

2.12 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD. Furnish gasketed cover by box manufacturer.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.13 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
1. Material: Galvanized cast iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. Fiberglass Concrete composite Handholes: Die-molded, glass-fiber concrete composite hand holes:
1. Cable Entrance: Pre-cut 6 inch x 6 inch (150 mm x 150 mm) cable entrance at center bottom of each side.
2. Cover: Glass-fiber concrete composite, weatherproof cover with nonskid finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maximum Size Conduit in Slab Above Grade: 3/4 inch (19 mm). Do not cross conduits in slab.

L. Maintain clearance between raceway and piping for maintenance purposes.

M. Maintain 12 inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

N. Cut conduit square using saw or pipe cutter; de-burr cut ends.

O. Bring conduit to shoulder of fittings; fasten securely.

P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

Q. Install conduit hubs or sealing locknuts to fasten conduit to cast boxes.

R. Install no more than equivalent of three 90 degree bends between boxes for power systems. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

S. Install no more than equivalent of two 90 degree bends between boxes for communications systems. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

T. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

U. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

V. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

W. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

Y. Close ends and unused openings in wireways, junction boxes, and pull boxes.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet (3 m) prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches (150 mm) separation. Install with minimum 24 inches (600 mm) separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 078400.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installer.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26 0533

SECTION 26 0534

FLOOR BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes floor boxes; floor box service fittings; poke-through fittings; and access floor boxes.

B. Related Sections:
1. Section 078400 - Firestopping: Firestopping for electrical work.
2. Section 260529 - Hangers and Supports for Electrical Systems: Firestopping for electrical work.
3. Section 260533 - Raceway and Boxes for Electrical Systems.
4. Section 262726 - Wiring Devices: Receptacles for installation in floor boxes.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures.

B. Product Data: Submit catalog data for floor boxes service fittings.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 FLOOR BOXES

A. Manufacturers:
1. Hubbell Wiring Products, Inc.
2. Wiremold, Inc.
3. Steel City, Inc.

4. FSR, Inc.

B. Floor Boxes: NEMA OS 1-1/2 inches deep.

C. Adjustability: Fully adjustable.

D. Material: Cast metal.

E. Shape: Rectangular.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify locations of floor boxes and outlets in finished spaces prior to rough-in.

3.2 INSTALLATION

A. Floor Box Requirements: Use cast floor boxes for all installations.

B. Set floor boxes level.

C. Install boxes and fittings to preserve fire resistance rating of slabs and other elements, using materials and methods specified in Section 078400.

D. Install protective rings on active flush cover service fittings.

3.3 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements:Testing, adjusting, and balancing.

B. Adjust floor box flush with finish flooring material.

3.4 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

END OF SECTION 26 0534

SECTION 26 0536

CABLE TRAYS

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 cable trays and accessories.

B. Related Sections include the following:
   1. Division 26 Section "Through-Penetration Firestop Systems" for firestopping materials and installation requirements.
   2. Division 26 Section "Basic Electrical Materials and Methods" for supports not specified in this Section.

1.3 SUBMITTALS

A. Product Data: Include data indicating dimensions and finishes for each type of cable tray.

B. Shop Drawings: Detail fabrication and installation of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

C. Design Calculations: Verify loading capacities for supports.

D. Coordination Drawings: Include floor plans and sections drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.

E. Factory-certified test reports of specified products, complying with NEMA VE 1.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements specified in "Field Quality Control" Article.

G. Maintenance Data: For cable trays to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

B. Listing and Labeling: Provide cable trays and accessories specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70 - 2008, Article 100.
C. Comply with NEMA VE 1, "Metal Cable Tray Systems," for materials, sizes, and configurations.

D. Comply with NFPA 70 - 2011.

1.5 PROJECT CONDITIONS
A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services.
   1. Notify Architect not less than 2 days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

1.6 COORDINATION

A. Coordinate layout and installation of cable tray with other installations.
   1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by, but not limited to, one of the following:
   1. B-Line Systems, Inc.
   2. Mono-Systems, Inc.
   3. MP Husky USA, Inc.

2.2 MATERIALS AND FINISHES
A. Cable Trays, Fittings, and Accessories: Stainless Steel.

B. Fabricate cable tray products with rounded edges and smooth surfaces.

C. Sizes and Configurations: Refer to Cable Tray Schedule at the end of the Section for specific requirements for types, materials, sizes, and configurations.

2.3 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as required, of same materials and finishes as cable tray.
B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.4 SOURCE QUALITY CONTROL

A. Perform design and production tests according to NEMA VE 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of cable trays. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cable tray level and plumb according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Remove burrs and sharp edges from cable trays.

C. Fasten cable tray supports securely to building structure.
   1. Locate and install supports according to NEMA VE 1.
   2. Design supports, including fastenings to the structure, to carry the greater of the calculated load multiplied by a safety factor of 4 or the calculated load plus 200 lb (90 kg).

D. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independently of fittings. Do not carry weight of cable tray on equipment enclosure.

E. Install expansion connectors where cable tray crosses a building expansion joint and in cable tray runs that exceed 90 feet (27 m). Space connectors and set gaps according to NEMA VE 1.

F. Make changes in direction and elevation using standard fittings.

G. Make cable tray connections using standard fittings.

H. Locate cable tray above piping, unless accessibility to cable tray is required or unless otherwise indicated.

J. Workspace: Install cable trays with sufficient space to permit access for installing cables.

3.3 CONNECTIONS

A. Ground cable trays according to manufacturer's instructions.

   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 WARNING SIGNS

A. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

3.5 FIELD QUALITY CONTROL

A. Grounding: Test cable trays to ensure electrical continuity of bonding and grounding connections.

B. Anchorage: Test pullout resistance for toggle bolts and powder-driven threaded studs for each type and size of anchorage material.
   1. Furnish equipment, including jacks, jigs, fixtures, and calibrated indicating scales, required for reliable testing.
   2. Obtain Architect's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener.

C. Replace malfunctioning units.

3.6 CLEANING

A. On completion of cable tray installation, including fittings, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

3.7 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cable tray is without damage or deterioration at the time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
   2. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

3.8 CABLE TRAY SCHEDULE

A. Description:

   1. Type: Basket type.
   2. Material and Finish: Mill-galvanized.
   3. Width: 12 inches.
   4. Inside Depth: 2 inches (minimum).
   5. NEMA Load/Span Class: 12C.

END OF SECTION 26 0536

SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Identification for conductors and control cable.
   2. Underground-line warning tape.
   3. Equipment identification labels.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70 - 2011.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.3 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Power-Circuit Conductor Identification: For secondary conductors in pull and junction boxes use color-coded tape.

B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape.

C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

D. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.

2. Equipment to Be Labeled:

    a. Panelboards, electrical cabinets, and enclosures.
    b. Access doors and panels for concealed electrical items.
    c. Disconnect switches.
    d. Enclosed circuit breakers.
    e. Fire-alarm control panel and annunciators.
    f. Monitoring and control equipment.
    g. Contactors.
    h. Lighting control panels.
    i. Generators and remote control panels.
    j. Automatic Transfer Switches

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.

2. Colors for 480/277-V Circuits:

    a. Phase A: Brown
    b. Phase B: Orange
    c. Phase C: Yellow
    d. Neutral: Gray
    e. Ground: Green

3. Colors for 120/208-V Circuits:

    a. Phase A: Black
    b. Phase B: Red
    c. Phase C: Blue
    d. Neutral: White
    e. Ground: Green

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

END OF SECTION 26 0553

SECTION 26 0923

BUILDING LIGHTING CONTROL SYSTEM

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 manually operated lighting controls with relays and control module.

B. This Section includes automatically operated lighting controls.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70-2011 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

1.4 SUBMITTALS

A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.

1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
2. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

C. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70 - 2011.

1.6 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.
2. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

B. Coordinate lighting control components specified in this Section with components specified in Division 26 Section "Panelboards."

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of software input/output to execute switching or dimming commands.
b. Failure of modular relays to operate under manual or software commands.
c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: One year from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Electrically Held Relays: Equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Leviton
2. Lutron Electronics Company, Inc.
3. Philips

4. Watt Stopper

2.2 SYSTEM REQUIREMENTS

A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

B. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

2.3 CONTROL MODULE

A. Control Module Description: Panelboard mounted; comply with UL 916 (CSA C22.2, No. 205); microprocessor based, solid-state, 365-day timing and control unit. Control units shall be programmable and capable of receiving inputs from sensors and other sources. Panelboard shall use low-voltage-controlled, electrically operated, molded-case branch circuit breakers as prime power-circuit switching devices. Circuit breakers and a limited number of digital or analog, low-voltage control-circuit outputs shall be individually controlled by control module. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable. Panelboard shall also comply with Division 26 Section "Panelboards."

1. Remote Communication Capability: Allow programming, data-gathering interrogation, status display, and controlled command override from a PC at a remote location over data links. System shall include modem, communications and control software, and remote computer compatibility verification for this purpose.
2. Telephone Override Capability: Override programmed lighting shutdown commands by telephoning computer and shall enter a voice-menu-guided, override touch-tone code specific to zone being controlled.
3. Local Override Capability: Manual, low-voltage control devices shall override programmed shutdown of lighting and shall override other programmed control for intervals that may be duration programmed.
4. Automatic Control of Local Override: Automatic control shall switch lighting off if lighting has been switched on by local override.
5. Automatic battery backup shall provide power to maintain program and system clock operation for 90 days' minimum duration when power is off.
6. Flick Warning: Programmable momentary turnoff of lights shall warn that programmed shutoff will occur after a preset interval. Warning shall be repeated after a second preset interval before end of programmed override period.
7. BMS interface: provide interface between control panel and BMS unit so lighting can be programmed/controlled by BMS.

2.4 POWER DISTRIBUTION COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.

    a. Barriers separate low-voltage and line-voltage components.
    b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
    c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.

    a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
    b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
    c. Endurance: 50,000 cycles at rated capacity.
    d. Mounting: Provision for easy removal and installation in relay cabinet.

B. Line-Voltage Surge Suppression: Field-mounting surge suppressors that comply with Division 26 Section "Transient Voltage Suppression" for Category A locations.

2.5 OCCUPANCY SENSORS

A. Provide “dual-technology” (infrared and ultrasonic) and “Ultrasonic only” type occupancy sensors as indicated on drawings. Provide all required power packs and accessories for full installation. In offices and classrooms, provide “manual on, automatic off” (vacancy sensor) configuration.

B. Provide auxiliary relay on sensors for use with BMS.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring in raceways. Comply with Division 26 Section "Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

E. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

G. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."

H. Install occupancy sensors per manufacturer’s installation instructions. Adjust sensitivity and time delay as approved by owner and engineer. Install sensors on ceiling mounted recessed box and aim appropriately.

I. Install daylight sensors per manufacturer’s installation instruction. Adjust sensitivity and time delay as approved by owner and engineer. Install sensors in optimal location to maximize daylight harvesting in the space.

J. Install timer switches wall mounted 48” aff (to top of device box).

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.
4. Test system diagnostics by simulating improper operation of several components selected by Architect.

3.3 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to visits to Project during other than normal occupancy hours for this purpose.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls systems. Training session shall be 4 hours.

END OF SECTION 26 0923

SECTION 26 2200

DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less:

1. Distribution transformers.

1.3 SUBMITTALS

A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C 57.12.91.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cutler-Hammer.

2. GE Electrical Distribution & Control.
3. Square D/Groupe Schneider NA.

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are internally braced to withstand seismic forces specified in Division 16 Section "Electrical Supports and Seismic Restraints."

C. Cores: One leg per phase.

D. Enclosure: Ventilated, NEMA 250, Type 2.

E. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."

1. Finish Color: Gray.

F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. K-Factor Rating: Transformers shall be K-factor rated (K-13) and comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

I. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed. Provide reinforcement of walls as required for proper mounting.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install floor-mounting transformers level on concrete pad.

1. Anchor transformers to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Division 26 Section "Electrical Supports and Seismic Restraints."

2. Maintain clearances as listed on transformer per NEC.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Land each conductor under a separate lug barrel.

END OF SECTION 26 2200

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Panelboard Schedules: For installation in panelboards, typed.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70 - 2011.

1.5 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, and Accessories:

a. Eaton Corporation; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Protection Div.
c. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1 and Type 3R (exterior).

1. Rated for environmental conditions at installed location.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
5. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase and Ground Buses:

1. Material: Tin-plated Copper.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Mechanical type.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches. Provide ground fault interrupting rating on panels as indicated.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices:

1. Bolt-on circuit breakers.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single-pole configurations with 30-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Electrical Supports and Seismic Restraints."

C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

F. Install filler plates in unused spaces.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Provide an electrician to open panels for substantial completion observation by Engineer.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Identify with red marking the breaker that feeds the fire alarm control panel (FACP) and provide a permanent “white lettering on red backboard” label on panel door that reads, “FIRE ALARM CIRCUIT CONTROL FED FROM THIS PANEL.” Provide non-tripping device on this breaker.

D. In panel directory identify in bold letters which circuits feed “EMERGENCY LIGHTING” circuits.

E. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 2416

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Snap switches.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70 - 2011.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 5351 (single), 5352 (duplex).
      b. Hubbell; HBL5351 (single), CR5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Combination Duplex receptacle/USB Charger, dual port, 125V, 20A: Comply with

      a. Cooper; TR7745.
      b. Hubbell; USB15X2.
      c. Leviton; T5630.
      d. Pass & Seymour; TR5362USBLA.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; GF20.
      b. Hubbell; GF5262.
      c. Leviton; 6899.
      d. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
      c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
      d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices. Provide jumbo size plates for devices installed in block walls; confirm with Architect.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material : Smooth, stainless steel, confirm with Architect..
3. Material for Damp Locations: Metallic with spring-loaded lift, “in use” type cover, and listed and labeled for use in wet locations. Cover shall be capable of being locked with padlock.

2.6 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70-2011, Article 300, without pigtails.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
7. All switches shall be ADA-compliant, not exceeding 48” aff mounting height to toggle.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multi-gang wall plates.

3.2 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
3. Using the test plug, verify that the device and its outlet box are securely mounted.
4. The tests shall be diagnostic, indicating damaged conductors, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones.

END OF SECTION 26 2726

SECTION 26 2813

FUSES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fuses and spare fuse cabinet.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 DESIGN REQUIREMENTS

A. Select fuses to provide appropriate levels of short circuit and overcurrent protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.

B. Select fuses to coordinate with time current characteristics of other overcurrent protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

1.4 FUSE PERFORMANCE REQUIREMENTS

A. General Purpose Branch Circuits: Class RK5 (non-time-delay).

B. Motor Branch Circuits: Class RK1 (time delay).

C. Exterior Lighting Branch Circuits: Provide HEB fuse holders with RTK type fuses for each exterior pole fixture and make accessible through pole access hole.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

1.6 MAINTENANCE MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two fuse pullers.

1.7 EXTRA MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish three spare fuses of each Class, size, and rating installed.

PART 2 PRODUCTS

2.1 FUSES

A. Manufacturers:
1. Cooper Industries, Inc.; Bussmann Div.
2. General Electric Co.; Wiring Devices Div.
3. Gould Shawmut.
4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.2 SPARE FUSE CABINET

A. Product Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

B. Doors: Hinged, with hasp for Owner's padlock.

C. Finish: Gray enamel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fuse with label oriented so manufacturer, type, and size are easily read.

END OF SECTION 26 2813

SECTION 262819

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fusible and nonfusible switches.

B. Related Sections:
1. Section 262813 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
4. Square D/Groupe Schneider.

B. Product Description: NEMA KS 1, Type HD (480v) and GD (208v), enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel or stainless steel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.
3. Damp Interior Locations: Type 4.

E. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

F. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Groupe Schneider.

B. Product Description: NEMA KS 1, Type GD (208v) enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel or stainless steel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.
3. Kitchen Locations: Type 4.

D. Furnish switches with entirely copper current carrying parts.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere).

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned enclosed switches.

B. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing enclosed switches to remain or to be reinstalled.

3.2 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 260529.

B. Height: 5 feet (1500 mm) to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 262813 for product requirements.

D. Install engraved plastic nameplates in accordance with Section 260553.

E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION 26 2819

SECTION 264100

LIGHTNING PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes air terminals, interconnecting conductors, grounding, and bonding for lightning protection.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 780 - Standard for the Installation of Lightning Protection Systems.

B. Underwriters Laboratories Inc.:
1. UL 96 - Lightning Protection Components.
2. UL 96A - Installation Requirements for Lightning Protection Systems.

1.3 SYSTEM DESCRIPTION

A. Description: Conductor system protecting entire building and having UL Master Label.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

C. Product Data: Submit catalog sheets showing dimensions and materials of each component, and include indication of listing in accordance with UL 96.

D. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Certificate of Compliance: Submit certificate from UL indicating approval of lightning protection systems.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 780.

B. Perform Work in accordance with UL 96A and furnish Master Label.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum three years experience.

B. Installer: Authorized installer of manufacturer with minimum three years experience.

C. Inspection Agency: Underwriter's Laboratories, Inc. (UL).

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with roofing and exterior and interior finish installations.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
1. A-C Lightning Security, Inc.
2. Approved Lightning Protection Co., Inc.
3. Harger Lightning Protection, Inc.
4. Heary Bros. Lightning Protection Co.
5. Independent Protection Co., Inc.
6. Preferred Lighting Protection, Inc.
7. Robbins Lightning, Inc.
8. Thompson Lightning Protection Co.

B. Product Listing: UL 96.

C. Air Terminals:
1. Material: Copper or Aluminum, compatible with roof structure, 18" in height.
2. Configuration: Solid.
3. Use adhesive base for single-ply roof installations.
4. Grounding Rods: Solid copper.
5. Ground Plate: Copper.
6. Conductors:
   a. Material: Copper.
   b. Configuration: Cable.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 780 and UL 96A.

B. Connect conductors using exothermic welding process. Protect adjacent construction elements and finishes from damage.

C. Conceal interior conductors within building finishes. Conceal exterior conductors where practical.

D. Bond exterior metal bodies on building to lightning protection system.

3.2 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform inspection and testing in accordance with UL 96A.

END OF SECTION 264100

SECTION 26 4313

SURGE PROTECTIVE DEVICES

(formerly TRANSIENT VOLTAGE SUPPRESSION)

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 describes the materials and installation requirements for Surge Protective Devices (SPDs), formerly TVSS, for the protection of AC electrical circuits.

1.3 STANDARDS

A. Underwriters Laboratories: UL 1449 and UL 1283.

B. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002.

C. National Electrical Code 2011: Article 285.

D. NEMA LS-1.

1.4 LISTING REQUIREMENTS

A. The SPD industry recently revised UL 1449 Third Edition, 2011 NEC Article 285, NEMA LS-1 and various other surge standards. UL 1449 Third Edition, effective 09/2009, includes extensive new independent performance testing. This specification centers on UL 1449 Third Edition certification to ensure comparable test evaluations and accessibility of UL's website to verify spec compliance.

B. SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.

1.5 SUBMITTAL REQUIREMENTS

A. Submittals shall include UL 1449 Listing documentation verifying:

1. Short Circuit Current Rating (SCCR)
2. Voltage Protection Ratings (VPRs) for all modes
3. Maximum Continuous Operating Voltage rating (MCOV)

4. I-nominal rating (I-n)
5. Type 1 Device Listing

B. Submittals shall include shop drawings including manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing all field connections and manufacturer's recommended wire and breaker sizes.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology, Inc.
2. LEA International.
3. Liebert Corporation; a division of Emerson.
4. APT (Advanced Protection Technology).

2.2 SURGE PROTECTIVE DEVICES (SPDs)

A. SPD shall be UL labeled with 200ka Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

B. SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every compression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over temperature controls.

C. SPD shall be UL labeled with 20kA nominal (L-N) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

D. Minimum surge current capability (single pulse rated) per phase shall be 100kA.

E. SPD shall provide surge current paths for all modes of protection: L-N, L-G, and N-G for Wye systems.

F. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	800V	800V	12000V	800V

480Y/277	1200V	1200V	18000V	1200V

G. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

H. SPD shall include visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED. SPD shall include an audible alarm with on/off silence function and diagnostic test function (excluding branch).

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60 amp breaker is not available.

B. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24" and straight as possible. Gently twist conductors together.

C. The contractor shall rearrange breaker locations to ensure shortest and straightest possible leads to SPDs.

D. Before energizing, the contractor shall verify service and separately derived system Neutral-to-Ground bonding jumpers per NEC.

3.2 FIELD QUALITY CONTROL

A. Testing: After installing surge protection devices, but electrical circuitry has been energized, test for compliance with requirements. Remove and replace malfunctioning units and retest.

END OF SECTION 26 4313

SECTION 26 5100

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

1.2 DEFINITIONS

A. Luminaire or Fixture: A complete lighting unit or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered emergency lighting units also include a battery and the means for controlling and recharging the battery.

B. LED Luminaire: LED luminaire: A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED based light emitting elements may take the form of LED packages (components), LED arrays (modules), LED Light Engine, or LED lamps. The LED luminaire is intended to connect directly to a branch circuit.

C. BF: Ballast factor.

D. CCT: Correlated Color Temperature.

E. CRI: Color-rendering index.

F. CU: Coefficient of utilization.

G. HID: High-intensity discharge.

H. LER: Luminaire efficacy rating.

I. RCR: Room cavity ratio.

J. SSL: Solid State Lighting (or LED)

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.
6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
   a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
   b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
7. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and LM79 report.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

   1. Wiring Diagrams: Power and control wiring.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Lighting fixtures.
   2. Suspended ceiling components.
   3. Structural members to which suspension systems for lighting fixtures will be attached.
   4. Other items in finished ceiling including the following:
      a. Air outlets and inlets.
      b. Speakers.
      c. Sprinklers.
      d. Smoke and fire detectors.
      e. Occupancy sensors.
      f. Access panels.
   5. Perimeter moldings.

D. Qualification Data: For agencies providing photometric data for lighting fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.6 WARRANTY

A. Special Warranty for LED Luminaires: Manufacturer's standard warranty for LED fixtures shall include the entire luminaire including Housing, LED modules, and LED drivers for a minimum of 5 years.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10% of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1% of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: 1% for each standalone emergency lighting unit. Furnish at least one of each type.
4. Ballasts: 1% of each type and rating installed. Furnish at least one of each type.
5. LED Drivers: 1% of each type and rating installed. Furnish at least one of each type.
6. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or prior approved equal.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

D. LED Luminaires: Comply with UL
1. General:
a. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
b. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
c. LED drivers shall include the following features unless otherwise indicated:
1) Minimum efficiency: 85% at full load.
2) Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
3) Input Voltage: 120 - 277V (±10%) at 60 Hz.
4) Integral short circuit, open circuit, and overload protection.
5) Power Factor: ≥ 0.95.
6) Comply with FCC 47 CFR Part 15.
d. LED modules shall include the following features unless otherwise indicated:
1) Comply with IES LM-79 and LM-80 requirements.
2) Minimum Rated Life: 50,000 hours per IES L70.
3) Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
e. LED Downlights: Housing, LED driver, and LED module shall be products of the same manufacturer.
f. LED Troffers: LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling. Housing, LED driver, and LED module shall all be products warranted from one manufacturer.

E. Metal Parts: Free of burrs and sharp corners and edges. Paint after fabrication.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2.3 DRIVERS FOR LED LUMINAIRES

A. Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.

1. Certification by Electrical Testing Laboratory (ETL). Can be UL recognized, but Listed when part of a fixture assembly.

2. Sound Rating: "A" rating.
3. Voltage: Match connected circuits.
4. Starting Temperature: -30 deg. C to 50 deg C.
5. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
6. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
7. Lamp-Driver connection method does not reduce normal rated life of lamps.

B. Drivers for Dimmer-Controlled Lighting Fixtures.

1. Dimming Range: 100 to 10 percent of rated lamp lumens.
2. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

C. Drivers for Bi-Level Controlled Lighting Fixtures.

1. Operating Modes: Driver circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 50 percent of rated lamp lumens.

2. Driver shall provide equal current to all LED modules boards for even lighting.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 42 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.85 or higher.
7. Power Factor: 0.95 or higher.
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.98 or higher.

C. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

D. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

E. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

F. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

a. High-Level Operation: 100 percent of rated lamp lumens.
b. Low-Level Operation: 50 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.5 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
11. Ballast Case Temperature: 75 deg C, maximum.

2.6 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.

2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

2.7 LAMPS

A. Fluorescent Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Electrical Supports and Seismic Restraints" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of two ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION 26 5100

SECTION 26 5600

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes exterior lighting units with luminaires, lamps, ballasts, poles/support structures, and accessories.

B. Related Sections include the following:

1. Division 26 Section "Interior Lighting" for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; and for exterior luminaires normally mounted on buildings.

1.3 DEFINITIONS

A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.

B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

1.4 SUBMITTALS

A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Materials and dimensions of luminaires and poles.
2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
3. High-intensity-discharge luminaire ballasts.

B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

C. Submit LM-79 or LED facts sheets for all proposed equals for LED fixtures.

1.5 QUALITY ASSURANCE

A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70 - 2011, Article 100, for their indicated use, location, and installation conditions by a testing agency acceptable to authorities having jurisdiction

B. Comply with ANSI C2.

C. Comply with NFPA 70 -2011.

D. FM Compliance: Units for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.

1.6 DELIVERY, STORAGE, AND HANDLING OF POLES

A. Store poles on decay-resistant treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until just before pole installation.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 1 for every 10 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Lighting Fixture Schedule on drawings.

2.2 LUMINAIRES

A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

B. Metal Parts: Free from burrs, sharp corners, and edges.

C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.

F. Exposed Hardware Material: Stainless steel.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

H. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.

I. High-Intensity-Discharge Ballasts: Comply with ANSI C82.4. Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.

J. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.

2.3 LUMINAIRE SUPPORT COMPONENTS

A. Description: Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.

B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mph (160 km/h) with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.

1. Strength Analysis: For each pole type and luminaire combination, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

C. Finish: Match finish of pole/support structure for tenon mount materials.

D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Will not cause galvanic action at contact points.
2. Mountings: Correctly position luminaire to provide indicated light distribution.
3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
4. Anchor-Bolt Template: Plywood or steel.

E. Pole/Support Structure Bases: Anchor type with hold-down or anchor bolts, leveling nuts, and bolt covers.

F. Concrete for Pole Foundations: Comply with Division 3 Section "Concrete and Cement Finish."

1. Design Strength: 3000-psig (20.7-MPa), 28-day compressive strength.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Concrete Foundations: Construct according to Division 3 Section "Concrete and Cement Finish."

1. Comply with details for reinforcement and for anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual pole bases furnished.
2. Finish for Parts Exposed to View: Trowel and rub smooth. Chamfer edges, grind ridges, and fill above grade cavities.

B. Install poles as follows:

1. Use web fabric slings (not chain or cable) to raise and set poles.
2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
3. Secure poles level, plumb, and square.

C. Luminaire Attachment: Fasten to indicated structural supports.

D. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow aiming for indicated light distribution.

E. Lamp luminaires with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

3.2 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Ground metal poles/support structures according to Division 26 Section "Grounding."

C. Pole lighting shall meet the supports and grounding requirements of article 410.30 of 2011 NEC.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged units.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:

1. Check intensity and uniformity of illumination.
2. Check excessively noisy ballasts.

E. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results.

F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.4 CLEANING AND ADJUSTING

A. Clean units after installation. Use methods and materials recommended by manufacturer.

B. Adjust amiable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities. Provide night time aiming of directional lighting fixures with Engineer present.

END OF SECTION 26 5600

SECTION 283111

FIRE ALARM SYSTEM

PART 1 - GENERAL

SUMMARY

This Section includes fire alarm systems. It includes requirements for system components including but not limited to the following:

Backboxes for fire alarm system devices.
Manual pull stations.
Single-Station type smoke detectors.
Spot type and duct smoke detectors.
Combination remote indicating light and test stations.
Spot type heat detectors.
Addressable interface units (AIU's).
Isolation control relays.
Sprinkler system flow and pressure alarm switches.
Sprinkler system valve tamper switches.
Monitoring of existing fire pump controllers.
Alarm notification appliances.
Firefighter's remote phone jack stations.
Surge Protection Devices (SPDs).
Emergency power supply.
Digital alarm communicator transmitter (DACT).
RJ-31X telephone jacks.
System instructions.
Tags.

DEFINITIONS

Active Multiplex System: A multiplexing system in which signaling devices are employed to transmit and receive status signals of each initiating device and/or initiating device circuit within a prescribed time interval so that lack of receipt of such signal may be interpreted as a trouble signal.

A.D.A.: Americans with Disabilities Act Guidelines.

Alarm Initiating Devices: Manual and automatic detection devices such as manual pull stations, heat detectors, and smoke detectors.

Alarm Notification Appliances: Devices such as audible-only alarm units (speakers), visible-only alarm units (strobes), and combination audible/visible alarm units.

Alarm Signal: Signifies a state of emergency requiring immediate action. Pertains to signals caused by the operation of alarm initiating devices.

Analog Smoke Detector: A smoke detector that transmits a signal indicating varying degrees of smoke density and includes a warning system to indicate when the detector is dirty and when the detector drifts outside of its listed sensitivity range. Detectors shall include an adjustable sensitivity feature capable of being manipulated at the fire alarm control panel.

Class B Wiring: Wiring method used to interface non-addressable detection devices to addressable interface units (AIU's)) and for notification appliance circuits. Class B circuits shall be electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FVCC and remote annunciator panels no matter where the break or ground fault condition occurs.

Notification Appliance Circuit (NAC): Circuit for connection of notification appliances. Circuits shall be electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FVCC and remote annunciator panels no matter where the break or ground fault condition occurs.

Signaling Line Circuit (SLC): Multiplex circuit for connection of alarm initiating devices. Circuits shall be electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FVCC and remote annunciator panels no matter where the break or ground fault condition occurs.

Supervisory Signal: Indicates need for action regarding maintenance of the fire detection and alarm system.

Trouble Signal: Indicates that a fault, such as an open circuit or ground, has occurred in the system.

Zone: Designation for an initiating device having a unique identity (for means of annunciation, status, and/or control) on a signaling line circuit.

SYSTEM DESCRIPTION

General: Active multiplex, addressable, microprocessor based type system with both manual and automatic alarm initiation, and both audible and visible evacuation alarms. Networked type systems shall not be provided. Subpanels, transponder panels, and/or power supply units located remotely from the fire alarm control panel shall not be provided unless otherwise indicated on the contract drawings. All components shall be provided integral to the fire alarm control panel cabinets.

Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.

Audible Alarm Indication: By digital voice alarm messages and tone signals on loudspeakers and by horns integral with smoke detectors (single-station type).

Visible Alarm Indication: By synchronized strobe light units that comply with NFPA 72 and A.D.A. guidelines.

System connections for alarm initiating devices: Devices shall be connected using signaling line circuits (multiplex addressable type).

System connections for alarm notification appliances: Devices shall be connected using Class B notification appliance circuits.

Functional Description: Provide a complete fire detection and alarm system and voice evacuation system with the following functions and operating features:

> Priority of Signals: Automatic response functions shall be accomplished by the first zone/device initiated. Alarm functions resulting from initiation by the first zone/device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. Supervisory or trouble signals shall have second- and third-level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.

Noninterfering: Provide zoned, powered, wired, and supervised system so that a signal from one zone/device does not prevent the receipt of signals from any other zone/device. All zones/devices shall be manually resettable from the FVCC after the initiating device or devices have been restored to normal. Systems that require the use of batteries or battery backup for the programming function are not acceptable and shall not be provided.

Transmission of Alarm Signals: Alarm signals shall be automatically routed to University of South Carolina Police Department via a digital alarm communicator transmitter (DACT).

Function Switches at FVCC and Remote Annunciator Panels: Switches shall provide capability for Alarm Acknowledgement, Supervisory Acknowledgement, Trouble Acknowledgement, System Reset, Alarm Silence, AHU Shutdown, and Drill / Full Evacuation.

Alarm Acknowledgement: Under normal conditions each panel shall display a "SYSTEM NORMAL" message. Should an abnormal condition be detected an appropriate LED (Alarm, Supervisory, or Trouble) shall flash and an audible signal shall be activated at each panel. Each panel shall display the following information relative to the abnormal condition of a point in the system:

1. Custom alarm point label (40 characters minimum)
2. Type of device (e.g., smoke detector, heat detector, manual pull station, etc.)
3. Point status (e.g., alarm, supervisory, trouble)

Pressing the appropriate acknowledge button shall acknowledge the alarm, supervisory, or trouble condition. After all the points have been acknowledged, the LED's shall glow steady and each panel's audible signal shall be silenced.

Alarm Silencing: Should the "Alarm Silence" button be pressed, all building and panel audible alarm signals shall cease operation. All building visible alarm signals shall continue operation.

System Reset: The "System Reset" button shall return the system to its normal state after an alarm condition has been remedied. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. Each panel's audible signal and the Alarm LED shall be on. Each display shall indicate the total number of alarms and troubles present in the system along with a prompting to review the points. These points shall not require acknowledgement if they were previously acknowledged.

AHU Shutdown: Should the "AHU Shutdown" button be pressed, all air handling units that include a duct smoke detector shall be shutdown automatically throughout the facility. Pressing the button a second time shall cause all air handling units to automatically restart (unless a unit's duct detector is in alarm).

Drill / General Evacuation: Should the "Drill / General Evacuation" button be pressed, all building audible alarm signals and visible signals shall be activated throughout the facility.

Power Loss Indication: Sound trouble signal at the FVCC and remote annunciator panel upon loss of primary power at the FVCC. Provide an indication at the FVCC and remote annunciator panel when the system is operating on an alternate power supply.

Remote Detector Status Indication:

Tamper: Status annunciation of individual smoke and heat detectors at the FVCC to indicate when a detector has been removed from its base.

Maintenance: Status annunciation of individual analog smoke detectors at the FVCC and the remote annunciator panel to indicate when a detector is dirty and requires cleaning or when it has drifted outside of its listed sensitivity range.

Remote Detector Sensitivity Adjustment: Manipulation of controls at the FVCC shall allow the selection of specific smoke and heat detectors for adjustment, display their current status and sensitivity settings, and control changes in those settings. Provide ability of using the same controls to program repetitive scheduled changes in sensitivity of specific detectors. These adjustments shall be capable of being made by the Owner's maintenance personnel and shall not require the use of additional and/or proprietary programming equipment.

Annunciation: Annunciate manual or automatic operation of any alarm or supervisory initiating device on the FVCC and the remote annunciator panel indicating the location and type device as indicated herein and as scheduled on the contract drawings.

Annunciator Display: 80 character (minimum) alphanumeric, liquid-crystal-display (LCD) type.

Signal Initiation: The manual or automatic operation of an alarm initiating or supervisory operating device shall cause the FVCC to transmit an appropriate signal including:

General Alarm: A system general alarm includes:

Indicating the general alarm condition at the FVCC and the remote annunciator panel.

Identifying the device that is the source of the alarm at the FVCC and the remote annunciator panel.

Automatic release of existing door holders.

Initiating voice/tone (via speakers) alarms and visible alarms as follows:

General: When the FVCC receives notification of a general alarm condition, all audible and visible alarms shall be activated throughout the facility.

The audio alarm signal of the voice alarm system shall consist of an alarm tone for approximately 10 seconds followed by automatic pre-selected voice evacuation messages (see message requirements under PRODUCTS section). At the end of each voice evacuation message, the alarm tone shall resume. The alarm tone and messages shall sound alternately until the alarm silence switch at the FVCC has been operated. Note that two different voice messages are required - one for the elevator cars and one for all other areas of the building.

Initiating transmission of the general alarm signal to a central monitoring station via a digital alarm communicator transmitter.

Trouble Alarm: A system trouble alarm includes:

Audible indication of the trouble/supervisory condition at the FVCC and the remote annunciator panel.

Identifying the device that is the source of the trouble/supervisory condition at the FVCC and the remote annunciator panel.

Initiating transmission of the trouble alarm signal to a central monitoring station via a digital alarm communicator transmitter.

Alarm initiation for installed fire detection devices shall be as follows:

Manual pull station alarm operation initiates a general alarm.

Smoke detector requiring maintenance/cleaning initiates trouble alarm.

Smoke detector alarm operation of spot type smoke detector shall activate a 60-second alarm delay. If after 60 seconds the alarm condition for the detector has cleared, the system shall be reset to normal. If after 60 seconds the alarm condition is still present, a general alarm shall be initiated.

Smoke detector alarm operation of an elevator lobby, hoistway, or machine room spot type detector shall activate both a general alarm and Firefighters' Service in compliance with ANSI A17.1. Firefighters' Service shall only be activated for the bank of elevators associated with the smoke detector in alarm.

Smoke detector alarm operation of single-station type smoke detectors:

Activates a 60-second alarm delay and the internal horn (sounder base) of single-station smoke detector. If after 60 seconds the alarm condition for the detector has cleared, the system shall be reset to normal and the sounder base horn shall automatically be turned off. If after 60 seconds the alarm condition is still present, the following shall occur:

First ten minutes in alarm (after alarm delay): Continues to sound internal horn (sounder base) of single-station detector and initiates a trouble alarm. If the detector is no longer in alarm, the sounder base horns shall be automatically turned off.

After first ten minutes in alarm: If no one acknowledges the alarm or resets the system at the FACP within the ten minute alarm period, a general alarm shall be initiated.

Removal of smoke detectors from their mounting bases initiates a trouble alarm.

Duct smoke detector alarm operation shall initiate a general alarm and shuts down its associated air handling unit fan. Any associated electric duct heaters shall also be shut down.

Heat detector alarm operation of spot type heat detectors initiates a general alarm.

Heat detector alarm operation of an elevator hoistway or machine room spot type detector shall activate both a general alarm and shall activate shunt-trip devices on existing circuit breakers that serve the associated elevator. (This only occurs for the “C” Tower elevator machine room and hoistway; elevator machine rooms and hoistways associated with the “A” and “B” Towers are not sprinklered).

Removal of heat detectors from their mounting bases initiates a trouble alarm.

Sprinkler system flow switch operation initiates a general alarm.

Sprinkler system pressure switch operation initiates a general alarm.

Sprinkler valve tamper switch operation initiates a trouble alarm.

Kitchen fire suppression system operation initiates a general alarm.

Independent System Monitoring: Supervise each detection device and each alarm notification device for both normal operation and trouble.

Circuit Supervision: Indicate circuit faults with both a zone and a trouble signal at the FVCC and the remote annunciator panel. Provide a distinctive indicating audible tone and (LED) indicating light.

The maximum elapsed time between the occurrence of an alarm or a trouble condition and its indication at the FVCC shall be 10 seconds. The maximum elapsed time between the occurrence of an alarm condition and activation of all associated notification devices shall be 10 seconds.

SUBMITTALS

General: Submit the following in accordance with Division 26 Section "Basic Electrical Requirements." The contractor shall not begin the installation of any raceways or boxes for the fire alarm system until shop drawings and product data have been reviewed by the Architect/Engineer.

Product Data: Submit product data for all fire alarm system components including dimensioned plans, sections, and elevations showing minimum clearances, installed features and devices, and list of materials.

Wiring Diagrams: Submit wiring diagrams from the manufacturer differentiating between manufacturer-installed and field-installed wiring. Include diagrams for equipment wiring and for system wiring with all terminals and interconnections identified. Include drawings indicating components for both field and factory panel wiring.

Shop Drawings: Submit shop drawings from the manufacturer indicating all horizontal and vertical building wiring for detection, alarm, and communications circuits. Include equipment types and locations, raceway sizes, number and type of wires/cables, and conductor color coding for each circuit type. Shop drawings shall be provided on 30" x 42" (E-size) prints. In addition to the requirements of Division 26 Section "Basic Electrical Requirements", final submittal shall include one set of shop drawings on a reproducible (vellum) media.

Battery Calculations: Submit battery capacity calculations for both alarm and supervisory modes.

Voltage Drop Calculations: Submit calculations for voltage drop of each notification appliance circuit.

System Operation Description: Submit system operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs. Description shall cover this specific project. Manufacturer's standard descriptions for generic systems are not acceptable.

Operation and Maintenance Data: Submit operation and maintenance data that will be included in the operating and maintenance manual specified in Division 26 Section "Basic Electrical Requirements." Operation and maintenance data shall cover each type of product, including all features and operating sequences, both automatic and manual. In addition, provide the following:

1. Spare parts data.
2. Names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the systems to be furnished.
3. A listing of the manufacturer’s representatives responsible for installation coordination and service.
4. A list of CPU addresses for every device that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.
5. A list of detector sensitivity setpoints for all installed smoke and heat detectors.

Product certification: Submit a product certification letter signed by the manufacturer of the fire alarm system components certifying that their products comply with the referenced standards.

QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who is a factory-authorized service representative and a licensed contractor in the State of South Carolina to perform the Work of this Section.

Compliance With Local Requirements: Comply with the Standard Building Code (SBCCI), local ordinances, local regulations, recommendations of the Barrier-Free Design Board (A.D.A.), requirements of the South Carolina Department of Labor (elevator code enforcement), and requirements of the local Fire Marshal (the authority having jurisdiction).

American National Standards Institute (ANSI): Installation of equipment, devices, and controls shall comply with:

CABO/ANSI A117.1, “Accessible and Usable Buildings and Facilities.”

ANSI/ASME A17.1, "Safety Code for Elevators and Escalators."

NFPA Compliance: Provide fire alarm and detection systems conforming to the requirements of the following publications:

NFPA 70, “National Electrical Code.”

NFPA 72, “National Fire Alarm Code.”

UL Listing and Labeling: Provide system and components specified in this Section that are listed and labeled by UL.

Single-Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility of system components furnished.

WARRANTY SERVICE

Warranty Service: Provide maintenance of fire alarm systems and equipment for a period of 12 months commencing with Substantial Completion, using factory-authorized service representatives.

Basic Services: Systematic, routine maintenance visits on a monthly basis at times coordinated with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

SPARE PARTS

Indoor-Type Visual-Only Alarm Unit: Furnish two devices of each rating provided for this project.

Spot Type Smoke Detector: Furnish ten.

Single-Station Type Smoke Detector with Sounder Base: Furnish five.

Spot Type Heat Detector - 135 Degree Type: Furnish five.

Spot Type Heat Detector - 190 Degree Type: Furnish TWO.

Standard Detector Base: Furnish ten.

PART 2 - PRODUCTS

MANUFACTURERS

Approved manufacturers are as follows:

1. Edwards (EST).
2. FCI
3. Notifier, Division of Pittway Corporation.
4. Simplex Time Recorder Company

BACKBOXES FOR FIRE ALARM SYSTEM DEVICES

Flush Type Backboxes for use in Indoor Conditioned Spaces:

Outlet and Device Backboxes: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application. Provide “old-work” type boxes where required for proper mounting in existing walls and ceilings.

Surface Type Backboxes for use in Indoor Conditioned Spaces:

Surface Raceway Backboxes for Fire Alarm System Devices: Metallic boxes made by surface raceway manufacturer with knockouts and accessories suitable for each location. Boxes shall have an ivory finish to match surface raceway.

Surface raceway boxes for square devices requiring the mounting screw pattern of a 4" square backbox shall be Wiremold Type V5752 or V5753 boxes (or prior approved equal) except as required below for custom surface device boxes.

Surface raceway boxes for round devices (detectors) shall be Wiremold Type V5737 or V5739 boxes (or prior approved equal).

Custom Surface Device Backboxes for Fire Alarm System Devices: Fire detection and alarm devices that do not properly mate with surface raceway boxes (e.g., manual pull stations) shall be mounted on custom made surface type backboxes specifically manufactured for the installed device. Device faceplates shall mate flush with outer edges of boxes. Custom boxes shall have not more than two stamped knockouts per box and shall be painted to match surface raceway or the installed device. Where applicable, proper surface raceway fittings shall be provided to interface conduit knockouts in custom boxes with surface raceway. Fittings shall be ivory in color to match surface raceway.

Surface Type Backboxes for use in Indoor and Outdoor Non-Conditioned Spaces:

Weatherproof type backboxes shall be provided for all devices located in non-conditioned spaces. Provide backboxes as scheduled on the contract drawings. Where backboxes are not scheduled, provide cast-metal boxes with threaded conduit hubs and neoprene gaskets (Crouse-Hinds, Appleton,

or equal). Drill two 1/8" weep holes in the bottom side of each box to allow water drainage. Provide weatherproof boxes that are manufactured by the fire alarm device manufacturer where available. Provide plugs in all unused conduit hubs.

MANUAL PULL STATIONS

Indoor Types for Use in Conditioned Spaces: Single-action type, fabricated of metal or plastic, and finished in red with molded raised letter operating instructions of contrasting color. Stations requiring the breaking of a glass panel shall not be provided. Stations that require the breaking of a concealed glass rod may be provided. Provide custom surface backbox and mounting trims for surface mount installations. See requirements for custom surface device boxes above.

Addressability: Provide manual pull stations with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC. The communication transmitter and receiver (AIU) shall be either integral to the station or remote mounted from the station, as indicated on the contract drawings.

Reset: Key-operated reset station switch, double pole, double throw, and rated for the voltage and current at which they operate. Provide stations with screw terminals for connections.

Cover: Provide an STI #6535 Mini Weather Stopper II (Safety Technology InterNational, phone number 1-800-888-4784) weatherproof cover/housing and an STI #6581 backplate for all manual pull stations. Sign/Message on front of housing shall read, "IN CASE OF FIRE - LIFT COVER AND PULL FIRE ALARM". Provide additional STI #6531 spacers and #6501 gaskets as required to accommodate pull station and backbox depth.

SINGLE-STATION TYPE SMOKE DETECTORS

General: Include the following features and characteristics:

Factory Nameplate: With serial number and type identification.

Operating Voltage: 24-V d.c., nominal.

Self-Restoring: Provide detectors that do not require resetting or readjustment after actuation to restore them to normal operation.

Plug-in Arrangement: Detector and associated encapsulated electronic components mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection shall require no springs for secure mounting and contact maintenance. Provide terminals in the fixed base for building wiring.

Visible Indicator: LED type connected to indicate detector has operated.

Analog Function: Transmit signals to indicate when a detector is dirty and requires cleaning or when it has drifted outside of its listed sensitivity range.

Addressability: Provide detectors with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC.

Sounder: Detector shall have an integral mini-horn which sounds only when smoke is detected by its associated smoke detector. Horn shall be rated 85 dB at 10 feet minimum.

Test Switch: Three position switch that simulates 0.85% and 3.5% actual smoke conditions in compliance with NFPA 72 and UL 217.

Maintenance Indicator: Indicator shall meet requirements for 100% testing.

Visible Alarm: Where indicated, provide detector with an integral 177 candela rated strobe unit that complies with A.D.A. guidelines. Lettering for strobe lens shall be oriented for ceiling mounted applications.

SPOT TYPE AND DUCT SMOKE DETECTORS

General: Comply with UL 268, "Smoke Detectors for Fire Protective Signalling Systems." Detectors shall be analog type and shall be provided with the following features:

Factory Nameplate: With serial number and type identification.

Operating Voltage: 24-V d.c., nominal.

Self-Restoring: Provide detectors that do not require resetting or readjustment after actuation to restore them to normal operation.

Plug-in Arrangement: Detector and associated encapsulated electronic components mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection shall require no springs for secure mounting and contact maintenance. Provide terminals in the fixed base for building wiring.

Visible Indicator: LED type connected to indicate detector has operated.

Analog Function: Transmit signals to indicate when a detector is dirty and requires cleaning or when it has drifted outside of its listed sensitivity range.

Addressability: Provide detectors with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC.

Spot Type Smoke Detectors: Include the following features and characteristics:

Sensor: Photoelectric type with infrared detector light source and matching silicon cell receiver.

Detector Sensitivity: Adjustable between 0.6 and 3.7 percent per foot smoke obscuration when tested in accordance with UL 268. Programmed/Installed setpoint for each detector shall be 3.7% per foot.

Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and that have the capability of having their sensitivity individually adjusted from the FVCC.

Weatherproof (WP) Detectors: Provide a weatherproof cast metal backbox with gasket for detectors indicated to be weatherproof (the intent is not to make the detector completely weatherproof, but to provide additional weather protection for the electronic components on the top-/back-side of the detector).

Duct Smoke Detector: Include the following features and characteristics:

Smoke detector with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Complete with housing and programmable relay as required for fan shutdown. Housings shall be of types that are surface mounted to the exterior of ducts to allow immediate access to smoke detector; housings manufactured to be installed within ducts shall not be provided.

Sensor: Photoelectric type with infrared detector light source and matching silicon cell receiver.

Detector Sensitivity: Adjustable between 0.6 and 3.7 percent per foot smoke obscuration when tested in accordance with UL 268. Programmed/Installed setpoint for each detector shall be 3.7% per foot.

Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and have capability of individually adjusting sensitivity from the FVCC. Detector units shall also shutdown air handling units via manual operation of control switch at the FVCC.

Programmable Relay: Each detector shall be provided with an integral programmable control relay that shall be rated to properly interface with the HVAC control system for shutdown functions. Provide an isolation relay of proper ratings if the detector relay ratings do not meet HVAC system control voltage and amperage requirements.

Provide weatherproof type units for roof mounted detectors.

COMBINATION REMOTE INDICATING LIGHT AND TEST STATIONS

General: Provide stations including a location-indicating, system-voltage light and a keyed test switch for remote status and testing of smoke detectors. Station components shall be attached to a wallplate for mounting on a single-gang wall or ceiling box, as applicable. Provide two keys to the Owner for each unit provided.

Weatherproof Units: Provide a weatherproof cast metal backbox with gasket for units indicated to be weatherproof. Provide an STI #6535 Mini Weather Stopper II (Safety Technology InterNational, phone number 1-800-888-4784) weatherproof cover/housing and an STI #6581 backplate to cover unit. Sign/Message on front of housing shall read, “DUCT DETECTOR TEST STATION”. Provide additional STI #6531 spacers and #6501 gaskets as required to accommodate test station and backbox depth.

SPOT TYPE HEAT DETECTORS

General: Comply with UL 521. Provide the following features:

Factory Nameplate: With serial number and type identification.

Visual Indicator: To indicate detector has operated.

Spot Type Heat Detectors - 135 Degree Type: Combination fixed-temperature and rate-of-rise unit.

Fixed Temperature Setting: Adjustable between 117 and 135 degrees Fahrenheit. Programmed/Installed setpoint for each detector shall be 135 degrees.

Self-Restoring: Provide detectors that do not require resetting or readjustment after actuation to restore them to normal operation.

Plug-in Arrangement: Detector and associated encapsulated electronic components mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection shall require no springs for secure mounting and contact maintenance. Provide terminals in the fixed base for building wiring.

Addressability: Provide detectors with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC.

Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and have capability of individually adjusting sensitivity from the FVCC.

Spot Type Heat Detectors - 190 Degree Type: Fixed-temperature only type unit. Fixed temperature setting shall be 190 degrees Fahrenheit. Remote mounted addressable interface units shall be provided to monitor detectors as indicated on plan.

Self-Restoring: Provide detectors that do not require resetting or readjustment after actuation to restore them to normal operation.

Plug-in Arrangement: Detector and associated encapsulated electronic components mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection shall require no springs for secure mounting and contact maintenance. Provide terminals in the fixed base for building wiring.

Addressability: Provide detectors with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC.

Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and have capability of individually adjusting sensitivity from the FVCC.

ADDRESSABLE INTERFACE UNITS (AIU's)

General: Addressable interface units designed to provide either the monitoring of system components not equipped for multiplex communication and/or the actuation of dry contacts based on the operation of other detection components in the fire detection system, as applicable. Provide units with a communication transmitter and receiver having a unique identification and status-reporting capability to the FVCC. Provide epoxy encapsulated units for mounting inside of a box; wallplate mounted units shall not be provided.

Provide a weatherproof cast metal backbox with cover and gasket for units indicated to be weatherproof.

Provide a NEMA 1 box with cover for units not indicated to be weatherproof.

ISOLATION CONTROL RELAYS

General: Electrical relay units designed to provide isolation of operating power from switched power for other control systems. Provide units with contact ratings as required for connected loads. Operating voltage shall be 24-V d.c., nominal. Output contacts shall be Form C relay type. Provide a weatherproof cast metal backbox with cover and gasket for each relay.

SPRINKLER SYSTEM FLOW AND PRESSURE ALARM SWITCHES

Provide addressable interface units (AIU's) and associated wiring as required to individually interface the switches to the fire alarm system. AIU's shall be programmed to "latch" upon alarm detection.

SPRINKLER SYSTEM VALVE TAMPER SWITCHES

Provide addressable interface units (AIU's) and associated wiring as required to interface the switches to the fire alarm system. AIU's shall be programmed to "latch" upon alarm detection.

ALARM NOTIFICATION APPLIANCES

General: Equip alarm notification devices for mounting as indicated. Provide terminal blocks for incoming and outgoing system connections.

Visible-Only Alarm Units:

Strobe lights utilizing high-intensity, clear, optic lens and xenon flash tube. Provide luminaires having their lenses mounted on an aluminum faceplate. Provide the word "FIRE" engraved in minimum 1-inch-high letters displayed on the unit. Orient lettering in accordance with mounting of unit (e.g., lettering for ceiling mounted units shall be horizontal across the lens, lettering for wall mounted units shall be vertical down the lens). Strobe leads shall be factory connected to screw terminals. Provide units with lamps having intensities as indicated on the contract drawings (minimum). Where a strobe unit manufacturer does not produce units with strobe intensities that match those indicated on the contract drawings, units with the next higher intensity above the intensity specified shall be provided. Intensity requirements indicated for each unit shall be met regardless of the viewing angle to the device (e.g., dual rated 15/75 candela strobes shall only be used for 15 candela applications).

Synchronized Flash: Units (and their associated notification appliance circuits) shall be arranged to provide a synchronized flash sequence for all visible alarm units throughout the facility.

Note that synch circuit modules specified below shall only be used on signal circuits that serve devices that they are approved and listed to serve. Provide additional notification appliance circuits/zones where required to ensure that devices and synch circuit modules produced by different manufacturers are segregated from one another.

Visible-Only Alarm Units, Outdoor Rated (Weatherproof), Wall Mounted: Provide the following, as applicable, or prior approved equal:

System Sensor #S241575K (15cd) with #WBB-R-1/2T-1/2B backbox.

System Sensor #S2475K (75cd) with #WBB-R-1/2T-1/2B backbox.

System Sensor #S24110K (110cd) with #WBB-R-1/2T-1/2B backbox.

Visible-Only Alarm Units, Indoor Rated, Wall Mounted: Provide the following, as applicable, or prior approved equal:

Wheelock #RSS-2415W-FR (15cd)

Wheelock #RSS-2430W-FR (30cd)

Wheelock #RSS-2475W-FR (75cd)

Wheelock #RSS-24110W-FR (110cd)

Visible-Only Alarm Units, Indoor Rated, Ceiling Mounted: Provide the following, as applicable, or prior approved equal:

Wheelock #RSS-2415C-FR (15cd)

Wheelock #RSS-2430C-FR (30cd)

Wheelock #RSS-2475C-FR (75cd)

Wheelock #RSS-24100C-FR (100cd)

Synch Circuit Modules for Wheelock Notification Devices: Provide Wheelock #SM-12/24-R, #DSM-12/24-R, or prior approved equal.

Synch Circuit Modules for System Sensor Notification Devices: Provide System Sensor #MDL, or prior approved equal.

Audible-Only Alarm Units: Comply with UL 1480, "Speakers for Fire Protective Signaling."

Speakers: Compression-driver type having a frequency response of 400 to 4,000 Hz for fire alarm horn tone and 125 Hz to 12,000 Hz for voice messages. Speakers shall be equipped with an alnico V magnet and a multiple tap, varnish impregnated, sealed matching transformer. Speakers shall be connected for 2 watt tap setting. Minimum output at 2 watt setting shall be 90 dB per UL 1480. Speakers shall be voltage-matched to the signal control panel amplifier output voltage.

Audible-Only Alarm Units, Indoor Rated, Ceiling Mounted with a Square Red Baffle: Provide Wheelock #ET70-R or prior approved equal.

Audible-Only Alarm Units, Outdoor Rated (Weatherproof) with a Square Red Baffle: Provide Wheelock #ET-1010-R with a Wheelock #WBB-R-1/2T-1/2B backbox or prior approved equal.

Combination Audible/Visible Alarm Units: Provide factory-combined audible and visible alarm units in a single mounting unit where indicated.

Combination Audible/Visible Alarm Units, Indoor Rated, Ceiling Mounted with a Round White Baffle: Provide the following, as applicable, or prior approved equal:

Wheelock #ET90-2415C-FW (15cd)

Wheelock #ET90-2430C-FW (30cd)

Wheelock #ET90-2475C-FW (75cd)

Wheelock #ET90-24100C-FW (100cd)

Combination Audible/Visible Alarm Units, Indoor Rated, Ceiling Mounted with a Square Red Baffle: Provide the following, as applicable, or prior approved equal:

Wheelock #ET70-2415W-FR (15cd) - Provide #SBB backbox for surface mount applications.

Wheelock #ET70-2430W-FR (30cd) - Provide #SBB backbox for surface mount applications.

Wheelock #ET70-2475W-FR (75cd) - Provide #SBB backbox for surface mount applications.

Wheelock #ET70-24110W-FR(110cd)-Provide #SBB backbox for surface mount applications.

Synch Circuit Modules: Provide Wheelock #SM-12/24-R, #DSM-12/24-R, or prior approved equal.

FIRE AND VOICE COMMAND CENTER (FVCC)

General: Comply with UL 864, "Control Units for Fire Protective Signaling Systems." Networked type systems including multiple control panels installed in different locations of the building shall not be provided unless otherwise indicated on the contract drawings. All components shall be provided integral to the fire alarm control panel cabinets.

Cabinets: Provide five, exactly matching, beige colored, lockable steel enclosures. Three cabinets shall have trims for surface mounting and the other two cabinets shall have trims for flush mounting as indicated on the contract drawings. Arrange panels so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. Provide cabinets large enough to accommodate all components and to allow ample gutter space for interconnection of panels as well as field wiring. Identify each enclosure and each component by an engraved red laminated phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than 1 inch high. Identify individual components and modules within the cabinets by engraved laminated phenolic resin nameplates. Provide custom tinting of auxiliary cabinets to obscure view of inner components.

Systems: Provide for separate and independent alarm and supervisory systems in the FVCC. The signaling line circuit loop boards in the FVCC shall consist of plug-in cards. Construction requiring removal of field wiring for module removal shall not be provided.

Control Modules: Types and capacities to perform all functions of the fire alarm system. Provide local, visible, and audible signals to notify of any alarm, supervisory, and trouble condition. Provide each type of audible alarm with a distinctly different sound.

Zones: Make provision in the FVCC for all detection, communications, and supervisory zones scheduled or otherwise required to provide the functions described herein and indicated on the contract drawings. Subpanels, transponder panels, and/or power supply units located remotely from the fire alarm control panels shall not be provided unless otherwise indicated on the contract drawings. All components shall be provided integral to the fire alarm control panel cabinets.

Notification Appliance Circuits: Separate notification appliance zones and associated circuits shall be provided for audible and visible notification appliances. They shall be arranged such that audible notification appliances can be silenced during a general alarm while the visible notification appliances remain flashing. Make provision in the FVCC for all notification appliance zones and circuits (audible and visible) scheduled or otherwise required to provide the functions described herein and indicated on the contract drawings. Power supply units located remotely from the fire alarm control panels shall not be provided unless otherwise indicated on the contract drawings. All components shall be provided integral to the fire alarm control panel cabinets.

> Synchronized Flash: Visible notification appliance circuits (and their associated visible alarm notification appliances) shall be arranged to provide a synchronized flash sequence for all visible alarm notification appliances throughout the facility.

Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at FVCC and addressable system components, including annunciation, supervision, and control. Provide a display with a minimum of 80 characters, arranged to display alarm, supervisory, and component status messages and indicate control commands to be entered into the system for control of smoke detector sensitivity and other parameters.

Voice Alarm: A digital-voice, integrated, UL listed, life safety, and emergency communication system, complying with the requirements of NFPA 72. The FVCC shall include central voice alarm system components complete with all necessary microphones, pre-amplifiers, amplifiers, and tone generators. Features shall include:

Amplifiers: Comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Provide amplifier wattage capacity to accommodate all audible notification appliances where each appliance is tapped at 2 watts.

Alarm Channels: Two channels to permit simultaneous transmission of different voice evacuation announcements to specific zones or floors as well as emergency public address announcements to specific areas via the central control microphone and remote microphone. All announcements shall be made over dedicated, supervised communication lines. A unique alarm announcement shall be provided for elevators.

Voice Alarm Messages:

General Message: May I have your attention please.
May I have your attention please.
A fire has been reported in the building.
A fire has been reported in the building.
Please proceed to the nearest exit and leave the building.
Do not use the elevator, but proceed to the nearest exit and leave the building.

Elevator Message: May I have your attention please.
May I have your attention please.
There has been a fire reported in the building.
When the elevator stops, please proceed to the nearest exit and leave the building.

Status Annunciator: Indicating the status of the various voice alarm speaker zones as well as the status of fire fighter telephone two-way communication zones.

Zoning: Provide individual voice alarm and communication zones as scheduled on the contract drawings to allow paging into specific areas.

Switches: Provide programmable switches within the FVCC (at the front desk) to perform paging to specific areas as scheduled on the contract drawings. Program a 5 minute time delay into the signal circuit supervisory alarm function as required to allow paging without initiating a supervisory (trouble) condition at the FVCC. The 5 minute delay shall be reset each time the microphone is keyed.

Fire Fighter's Telephone System: The FVCC shall include modules to control two way fire fighter's communication system via dedicated two-way supervised voice communication links between the FVCC and remote phone stations throughout the facility. The supervised telephone lines shall be capable of being connected to the talk circuits by the fire officer at the FVCC. The fire officer shall have the ability to disconnect phones from the talk circuits should too many phones be in use simultaneously. Two-way communications shall be static-free and clear. Include the following items:

Master Handset and Signals: At the FVCC (front desk), the telephone communication system shall incorporate the master handset, an audible pulse and tone generator, and a high-intensity lamp. When a remote phone is activated it shall cause the audible signal to sound and the high-intensity lamp to flash. Separate zones shall be provided as scheduled on the contract drawings such that the fire officer can determine the floor on which a firefighter is calling in from.

Spare Telephone Handsets: High-impact plastic handset, heavy-duty coil cord, and hook switch for connection to the FVCC by means of dedicated, supervised communication lines. Provide handsets having a dynamic receiver and a carbon transmitter, operating on 24-V d.c. Furnish 10 (ten) handsets.

Spare Handset Rack: Provide racks for spare firefighter's telephone handsets. Mount racks in the auxiliary FVCC system cabinet at the front desk. Racks shall accommodate all spare handsets.

Selector Panel: Controls simultaneous operation of telephones in selected zones and permits up to five phones to be operated simultaneously (in a common talk mode). Indicate ground faults and open or shorted telephone lines on the panel front by individual LED indicators. Provide telephone zone selector switches with associated LED indicators to permit the fire officer to activate selected telephone zones.

Programmable Switches: Provide switches as specified herein and as scheduled on the contract drawings.

TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

General: Provide a transient voltage surge suppression device to protect the primary power branch circuits to the FVCC. Devices shall be specifically designed and UL listed to protect the type of circuit connected thereto. Fuses are not acceptable and shall not be provided.

EMERGENCY POWER SUPPLY

General: Provide an emergency power supply for the FVCC. Components shall include batteries, charger, an automatic transfer switch, and a mounting enclosure. The emergency power system may be provided integral with the FVCC cabinets in lieu of providing a separate enclosure.

Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (nonalarm) mode for a period of 4 hours. Following this period of operation on battery power, the batteries shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 5 minutes.

Automatic Transfer Switch: Transfer the load to the battery without loss of signals or status indications in the event of the failure of primary power.

Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger shall recharge them fully within twelve hours. Charger output shall be supervised as part of system power supply supervision. Charger unit shall include the following features: Ammeter, Voltmeter, "Charger On" LED indicator, "Charger Trouble" LED indicator, and a "High Charge Rate" LED indicator.

Battery Enclosure (if required): Vented steel enclosure primed and finished in red paint.

DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT)

Provide a digital alarm communicator transmitter that is UL listed for commercial fire reporting in accordance with NFPA 72. Unit shall include a two-line Digital Alarm Communication Transmitter (DACT) for communicating with a central monitoring station. The DACT shall be provided integral with the FVCC; a separate panel shall not be provided. The DACT shall be capable of transmitting all data as specified herein.

Communicator Program: The system shall have a dual telephone line transmission feature. The first line shall be capable of dialing 2 telephone numbers, of 15 digits each using the switched telephone network such that if 2 unsuccessful attempts are made to the first number the system shall

automatically switch to the second number and make 2 attempts. If these 2 attempts are unsuccessful the system shall switch between numbers after 2 attempts each, until a successful connection is made or a maximum of 10 tries are attempted. Once 10 unsuccessful attempts are made the system shall stop dialing. Should another event occur which requires a message to be transmitted the dialing process shall be repeated. This line shall be supervised. If the first line is tampered-with or cut-off, the second line shall transmit an alarm to the central station.

Automatic Recall Time: The system shall transmit an Automatic Recall Message using the digital alarm communicating transmitter to test communications, each 24 hours.

Communication Failure Alarm: Should the digital alarm communicating transmitter fail to communicate with the central monitoring station receiver on 3 successive attempts, a trouble condition shall be activated in the FVCC.

Alarm Signals: The system shall be configured to a general alarm signal, and a trouble signal.

Communication Reporting Format: The communicator shall be capable of communicating to a central monitoring station using the Silent Knight 4+2 Extended format and the Contact ID format.

Emergency Power Supply: Emergency power for the DACT unit shall be provided from the FVCC emergency power supply system specified above.

Central Station Coordination: Provide system programming and coordination with the central monitoring station as required to establish proper communications and communicate alarm signals.

RJ-31X TELEPHONE JACKS

General: Provide two RJ-31X telephone jacks for connection of DACT unit to telephone lines. Jacks shall be ADI part #MO-RJ31X (ADI phone number 803/754-9289) or equal.

REMOTE ANNUNCIATOR PANEL

General: Provide an annunciator panel for the remote annunciation of alarm, supervisory, and trouble conditions. Panel shall be arranged for surface mounting as indicated on the contract drawings. Color of panel and associated trim shall be red unless prior approved by the Architect/Engineer.

Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator and addressable system components, including annunciation, supervision, and control. Provide a display with a minimum of 80 characters, arranged to display alarm, supervisory, and component status messages.

Switches: Provide programmable type switches to perform system control functions as specified herein and scheduled on the contract drawings.

Keyed Lock-Out Switch: Provide a keyed switch that will lock-out (disable) local operation of accessible switches on the front of the remote annunciator panel. Provide two keys to the Owner.

SYSTEM INSTRUCTIONS

Instructions: Provide typeset, printed, or typewritten instruction cards mounted behind lexan plastic or glass covers in a stainless steel or aluminum frame. Frame shall be painted high-gloss beige. Describe steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions: normal, alarm, and trouble. Provide one framed set of instructions adjacent to

the FVCC and one adjacent to the remote annunciator panel. Obtain approval for instructions before mounting.

TAGS

Tags For Identifying Tested Components: Comply with NFPA 72.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Install system in accordance with Codes and Standards referenced in Parts 1 and 2 of this Section.

EQUIPMENT INSTALLATION

Existing Fire Alarm Equipment: Maintain fully operational until the new equipment has been tested and accepted. As new equipment is installed, labeled it "NOT IN SERVICE" until the new equipment is accepted. Remove tags from new equipment when put into service and tag existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

Equipment Removal: remove existing, disconnected fire alarm equipment turn over to Todd Griffin with USC.

Backboxes for Fire Alarm System Devices: Install recessed boxes adjacent to structural members where possible and fasten boxes to structural members for added support.

Manual Pull Stations: Mount as indicated on the contract drawings. Remote mount associated addressable interface units where indicated on the contract drawings.

Single-Station Type Smoke Detectors: : Install detectors indicated to be ceiling mounted not less than 4 inches from a side wall to the near edge. Detectors shall be semi-flush mounted on recessed backboxes unless noted or detailed otherwise. Backboxes shall be supported independent of acoustical drop ceilings. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. Install detectors no closer than 3 feet from air registers unless prior approved by the Architect/Engineer. Provide a cast metal backbox with gasket for detectors indicated to be weatherproof.

Spot Type Smoke Detectors: Install detectors indicated to be ceiling mounted not less than 4 inches from a side wall to the near edge. Detectors shall be semi-flush mounted on recessed backboxes unless noted or detailed otherwise. Backboxes shall be supported independent of acoustical drop ceilings. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. Install detectors no closer than 3 feet from air registers unless prior approved by the Architect/Engineer. Provide a cast metal backbox with gasket for detectors indicated to be weatherproof.

Duct Smoke Detectors: Mount units in duct work as recommended by the manufacturer and in accordance with NFPA 72 and 90A. Provide all electrical power and control circuits as required to shutdown air handlers and any associated duct heaters.

Combination Remote Indicating Light and Test Stations:

Ceiling Mounted: Mount stations in a single-gang, recessed, “old-work” type box for stations indicated to be ceiling mounted. Mount station in ceiling as close in proximity to the detector as practical.

Wall Mounted: Mount stations in a single-gang, surface raceway type wall box at 48 inches above finished floor. Provide a cast metal backbox with gasket and weatherproof cover for stations indicated to be weatherproof.

Spot Type Heat Detectors: Install detectors indicated to be ceiling mounted not less than 4 inches from a side wall to the near edge. Detectors shall be semi-flush mounted on recessed backboxes unless noted or detailed otherwise. Backboxes shall be supported independent of acoustical drop ceilings. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. Install detectors no closer than 3 feet from air registers unless prior approved by the Architect/Engineer. Provide a cast metal backbox with gasket for detectors indicated to be weatherproof.

Addressable Interface Units: Provide a cast metal box with gasket and cover for units indicated to be weatherproof. Install units in a NEMA 1 enclosure at locations not indicated to be weatherproof.

Isolation Control Relays: Provide a cast metal box with gasket and cover for each unit.

Sprinkler System Flow and Pressure Alarm Switches: Provide addressable interface units and associated raceway and wiring as required to monitor each switch. Raceway connections at switches shall be made with liquid-tight flexible metal conduit.

Sprinkler System Valve Tamper Switches: Provide addressable interface units and associated raceway and wiring as required to monitor each switch. Raceway connections at switches shall be made with liquid-tight flexible metal conduit.

Alarm Notification Appliances: Mount as indicated on the contract drawings. Provide supervised wiring of units, zoned as scheduled on the contract drawings. Tap speakers at 2-watt setting. Mount Synch Circuit modules for visible notification appliance circuits in auxiliary FVCC cabinets unless prior approved by the Architect/Engineer.

Firefighter’s Remote Phone Jack Stations: Mount stations not indicated to be weatherproof in a single-gang flush wall box at 48 inches above finished floor. Provide a cast metal backbox with gasket and STI weatherproof cover for stations indicated to be weatherproof.

Fire and Voice Command Center Panels: Mount with tops of cabinets not more than 6 feet above the finished floor. Provide surface mounted units as indicated on the contract drawings.

Transient Voltage Surge Suppression Device: Install device either integral with the FVCC cabinets or adjacent to the FVCC cabinets in a NEMA 1 enclosure.

Battery Enclosure: Wall or floor mount on unistrut framing members. Securely fasten enclosure to wall or floor to avoid accidental spillage.

Digital Alarm Communicator Transmitter: Provide telephone line connections from the existing telephone backboard to the DACT as indicated on the contract drawings. Coordinate telephone line requirements with the Owner and telephone utility to ensure that proper telephone lines are used in accordance with NFPA 72 and the DACT manufacturer’s requirements. Provide system programming and coordination with the central monitoring station as required to establish proper communications and communicate alarm signals.

RJ-31X Telephone Jacks: Mount jacks in one of the FVCC auxiliary cabinets. Provide one 4-pair, #24 AWG, Category 6 communications cable from the existing telephone backboard to each jack in EMT raceway.

Remote Annunciator Panel: Mount as indicated on the contract drawings with top of panel at 60" above finished floor.

System Instructions: Securely fasten framed system instructions to walls at 60" above finished floor.

STI Weatherproof Covers: Install covers in accordance with the manufacturer's written instructions. Provide additional gaskets and conduit spacers where required for a proper installation.

WIRING AND RACEWAY INSTALLATION

General: Provide raceway and wiring to all equipment and devices indicated on the contract drawings. The contract drawings indicate partial raceway and wiring requirements to help clarify design intent. Where raceway and wiring is not indicated on the drawings for devices or equipment, the arrangement, grouping, and routing of raceway and wiring shall be provided by the contractor in accordance with the National Electrical Code and in accordance with methods outlined in the contract specifications and drawings.

Wiring: Provide wiring in accordance with Division 26 specification section "Wires and Cables."

Raceways: Install all wiring in metal raceway in accordance with Division 26 specification section "Raceways."

Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors associated with the fire alarm system that are terminated, spliced, or interrupted to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

Cable Taps and Splices: Cable taps and splices shall be kept to a minimum and shall only be allowed in addressable signaling line circuits; cable taps and splices shall not be provided in notification appliance circuits (most alarm notification appliances have both incoming and outgoing connection terminals – with proper planning there should be no need to splice a notification appliance circuit). Provide numbered terminal strips in junction boxes, pull boxes, outlet boxes, cabinets, and equipment enclosures where any tap or splice is made. Solder and/or wire nuts shall not be used.

Color Coding: Color code all fire alarm conductors differently from the normal building power wiring. Provide one color code for audible notification appliance circuits and a different color code for visible notification appliance circuits. Provide a different color code for signaling line circuits. Paint concealed fire alarm system junction boxes and covers red.

GROUNDING

Ground equipment and conductor and cable shields. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide ground from main service equipment to FVCC.

FIELD QUALITY CONTROL

Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable. The letter shall include the names and titles of the witnesses to the preliminary tests.

Final Test Notice: Provide 10 days' minimum notice in writing when the system is ready for final acceptance testing.

Minimum System Tests: Test the system in accordance with the procedures outlined in NFPA 72. Minimum required tests are as follows:

Verify the absence of unwanted voltages between circuit conductors and ground.

Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Proper signal transmission in accordance with class of wiring used shall be observed.

Test each initiating and indicating device for alarm operating and proper response at the control unit. Test smoke detectors with actual products of combustion.

Test the system for all specified functions in accordance with the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.

Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.

Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

COMMISSIONING

Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.

Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.

Schedule training with the Owner in writing at least seven days in advance.

Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, detector sensitivity setpoints, and controls to suit actual occupied conditions. Provide three 8-hour visits to the site for this purpose.

END OF SECTION 28 3111

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, removing site utilities and abandoning site utilities in place.
7. Temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically 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 and is 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 more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other 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 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.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site

1.7 PROJECT 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 traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated. Coordinate with Owner.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. 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.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches (1372 mm) above the ground.

C. 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 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Tree Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place. Coordinate with Electrical and Mechanical Plans for specific information related to steam, power, underground conduit, natural gas, or telephone lines.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

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

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in Division 22, Division 23, Division 26, and Division 33 Sections.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Completely remove stumps and roots, obstructions, and debris from the site.

3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer as specified on design plans, Section 312000 Earthmoving, or to a density equal to adjacent original ground whichever is more stringent.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials. See geotechnical report for thicknesses.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 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.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 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.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Preparing and grading subgrades for slabs-on-grade, and landscaping.

2. Excavating and backfilling for buildings and structures.

3. Drainage and moisture-control fill course for slabs-on-grade.

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

1. Division 31 Section “Site Clearing” for coordination,
1. Division 32 Section "Landscape Work" for finish grading, including placing and preparing topsoil for lawns and planting.

1.3 UNIT PRICES

A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches beneath bottom of concrete slabs on grade.

B. Unit prices for rock excavation include replacement with approved suitable materials.

1.4 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

D. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

E. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Test Reports: In addition to test reports required under field quality control, submit the following:

1. Laboratory analysis of each soil material proposed for fill and backfill from borrow sources.

2. One optimum moisture-maximum density curve for each soil material.

3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.6 QUALITY ASSURANCE

A. Testing and Inspection Service: Testing will be provided as described under Section 01 40 00 – Quality Control to provide a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

B. The Contractor shall fully comply with all provisions of the Contract Documents including, but not limited to, providing and installing such entities as the products, materials, equipment, components, or systems that were proposed at the time bids were received. Except for extenuating circumstances as determined by the Architect, notification of not being able to meet any of the provisions of the Contract Documents or communicating conflicts in the Contract Documents to the Architect will not be considered after receipt of bids; and the Contractor shall fully comply with the Contract Documents at no increase in Contract Sum or Contract Time.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

1. Provide a minimum 48-hours' notice to the Owner and architect and receive written notice to proceed before interrupting any utility.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

C. Contractor to carefully review and study the geotechnical report included as part of these investigations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. See Geotechnical report for recommendations of onsite material and use as suitable fill material. See Fill Blending instructions with offsite SP soils in the below section for fill areas.

B. Satisfactory Soil Materials for Import: USCS soil classification groups SW, SP, SC, and SM; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

C. Unsatisfactory Soil Materials for Import: USCS soil classification groups ML, MH, CL, CH, OL, and OH.

D. Backfill and Fill Materials: Satisfactory soil materials as noted in the Geotechnical report.

E. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 8 sieve.

F. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

G. Clean Sand (SP) clean sands

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Perform and include private utility locate for any areas where cuts or trenches are proposed prior to land disturbing activity.

C. Erosion Control
1. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of water runoff, soil-bearing water runoff, or airborne dust to adjacent properties, walkways, roadways, and structures. The Contractor shall be responsible for all consequential damage and resulting cleanup and repairs caused by soil erosion and discharge of water runoff, and soil-bearing water runoff, or airborne dust to adjacent properties, walkways, roadways, and structures.
2. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

3. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Strip topsoil from any fill areas and stockpile to be respread for landscaping.

E. Following general stripping, the proposed fill or cut areas of the building and pavement subgrade areas should be inspected by the testing firm and profrolled to detect locally yielding soils.

F. Contractor to verify that adequate dense bearing soils are present within any foundation subgrades, as noted in the geotechnical report recommendations.

G. Proofroll shall be performed in accordance with the geotechnical report recommendations.

3.2 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

C. Lower water table to a minimum depth of at least 2 feet below bearing levels and excavation bottoms during construction.

3.3 EXCAVATION

A. Classified Excavation: Excavation is classified and includes excavation to required subgrade elevations. Excavation will be classified as earth excavation or rock excavation as follows:

1. Earth excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with soil and other materials encountered that are not classified as rock or unauthorized excavation.

   a. Intermittent drilling or ripping to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.
   b. The width of trench excavation for pipe shall be the equal to the pipe diameter plus 16 inches.

2. Rock excavation includes removal and disposal of rock material and obstructions encountered that cannot be removed by the following heavy-duty rock excavating equipment without systematic drilling, blasting, or ripping.

   a. Rock material includes boulders 1 cu. yd. or more in volume and rock in beds, ledges, unstratified masses, and conglomerate deposits.

3. Rock Excavation and Ripping Criteria
   a. Massive Rock Excavation: Where Partially weathered rock may be encountered, these materials will require pre-loosening with a large bulldozer, such as a Caterpillar D8R, or equivalent, equipped with a single tooth ripper, having a drawbar pull rated at not less than 56,000 pounds. Any material that cannot be excavated with a single tooth ripper drawn by a crawler tractor having a minimum

fly wheel power rated not less than 285 horsepower (Caterpiller D8R or equivalent) and occupying an original volume of at least one cubic yard shall be classified as rock excavation.

b. Trench Excavation: Any material that cannot be excavated with a caterpiller 315C and occupying an original volume of at least 1 cubic yard or more.

4. Rock excavation will be paid by unit prices included in the Contract Documents.
5. Do not excavate rock until it has been classified and cross-sectioned by Testing Firm.

3.4 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 APPROVAL OF SUBGRADE

A. Notify Testing Firm when excavations have reached required subgrade.

B. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

C. When Testing Firm determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Testing Firm.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Architect.

1. Fill unauthorized excavations under other construction as directed by the Architect.

B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust. Permanent stockpile materials to be hydroseeded and stabilized.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter draining, perimeter insulation.

2. Surveying locations of underground utilities for record documents.

3. Testing, inspecting, and approval of underground utilities.

4. Concrete formwork removal.

5. Removal of trash and debris from excavation.

6. Removal of temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.10 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

1. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and recompact to required density.

3.11 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

    a. Stockpile or spread and dry removed wet satisfactory soil material.

3.12 TOPSOIL

A. Provide offsite imported screened topsoil free of any rocks, debris, etc. 1" or larger to spread within new landscape islands.

B. Spread topsoil minimum 2 inches deep on all graded areas unless shown or stated otherwise. Obtain, transport, and spread suitable topsoil from other approved and acceptable sources as part of the contract.

C. Begin spreading operation on the steepest portion of the slope and proceed to the flattest portion of the slope.

3.13 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D698-00:

    1. Under Structures, Building Slabs, Steps, Pavement, and Walkways: Compact the top 18 inches below subgrade and each layer of backfill or fill material at a minimum of 98 percent maximum dry density.

    2. Under Lawns or Unpaved Areas: Compaction for all other areas shall be a minimum of 92 percent maximum dry density for all structural fill.

3.14 GRADING

A. General: Uniformly grade areas to a smooth, even surface, free from irregular surface changes. Remove ridges and ruts. Fill depressions. In areas to be grassed, remove stones larger than 1.5 inches in any direction. Comply with COMPACTION requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

3. Slope finish grade away from perimeter of structure, sidewalks, pads, and pavement, to ensure positive drainage away from structures, sidewalks, pads, and pavement. Slope a minimum of 2 percent (1/4 inch per foot).

3.15 DRAINAGE FILL

A. Under slabs-on-grade, place drainage fill course on prepared subgrade.

1. Compact drainage fill to required cross sections and thickness.

2. When compacted thickness of drainage fill is 6 inches or less, place materials in a single layer.

3. When compacted thickness of drainage fill exceeds 6 inches thick place materials in equal layers, with no layer more than 6 inches thick nor less than 3 inches thick when compacted.

3.16 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable.

a. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.

b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.

2. Footing Subgrade: At footing subgrades, have testing firm observe and Dynamic Cone Penetrometer values obtained to confirm that the bearing soils are acceptable for the recommended bearing pressure.

3. For all fill areas Areas: At subgrade and at each compacted fill and backfill layer, perform compaction testing at a miniumum frequency of one test per lift per 2000 sq. ft. or less of fill placed.

4. Utility Trench Backfill: In each compacted backfill layer, perform at least one test per lift per 200 feet of fill placed within utility trenches where extended beneath pavement or structures.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained or as directed by geotechnical engineer.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal

1. Transport surplus satisfactory soil to designated storage areas on the Owner's property. Stockpile or spread soil as directed by Architect.

2. Remove waste material, trash, and debris, and legally dispose of it off the Owner's property.

3. Remove unsatisfactory soil and legally dispose of it off the Owner's property.

END OF SECTION 31 20 00

SECTION 31 25 00
ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Division 31 Section 31 10 00 “Site Clearing” for coordination

C. Division 31 Section 31 20 00 “Earth Moving” for coordination

1.2 SUMMARY

A. This Section includes guidelines pertaining to protection of the environment. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Environmental protections include:

1. Avoiding erosion and sedimentation.
2. Avoiding air pollution.
3. Avoiding water pollution.
4. Avoiding noise pollution.
5. General housekeeping.

B. DHEC (South Carolina Department of Health and Environmental Control), Architect, Owner, and authority having jurisdiction may inspect periodically during construction.

C. Related Sections include the following:

1. Division 01 Section “Execution” for developing a schedule of required tests and inspections.
2. Division 01 Section “Tree Protection” for treatment of vegetation to remain.

1.3 DEFINITIONS

1. Sediment Basin: Basin designed to collect and detain sediment-laden storm water runoff and release, at a slower rate, a much cleaner, better quality water.

2. Diversion Berm and Ditch: Temporary soil berm or ridge, excavated channel, or a combination berm and channel across sloping land to protect work areas or existing storm drains from upslope runoff and to divert sediment-laden water to sediment basins or traps or stable outlets.

3. Temporary Sediment Trap: Small, temporary ponding basin formed by an embankment to detain runoff and trap sediment below drainage area of 5 acres or less.

4. Silt Fence: Temporary sediment barrier constructed of filter fabric, buried at the bottom, stretched and supported by posts.

    a. Posts, minimum 10-gauge self-fastener angle steel type, five feet in length.

b. Wire mesh is required unless a synthetic, extra strength filter fabric providing puncture strength of 50 psi in accordance with ASTM D751 is used, and provided a 6'-0" maximum post spacing is used.

1.4 GENERAL

A. This section provides requirements and guidelines pertaining to protection of the environment during the construction of this project. The intent of this section is to control and thereby minimize or prevent soil erosion, sedimentation/siltation, air pollution, and water pollution as a result of this project.

B. Contractor shall be completely responsible for controlling erosion and sedimentation and to prevent damage or nuisance to public and private property caused by erosion or sedimentation from this project. Contractor shall prevent erosion of soil on the site and on adjacent property resulting from his construction activities and shall prevent sediment from leaving the site. Effective sediment and erosion control measures shall be initiated prior to the commencement of any demolition, clearing, grading, excavation, or other operations that will disturb the site or the natural protection provided by the site.

C. Coordination and Scheduling. Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation shall be preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located and construction traffic shall be routed to minimize soil disturbance and erosion.
   1. Install required measures where and as indicated on the drawings. If not indicated, coordinate with the Architect and locate in suitable and applicable locations to provide the necessary control measures.

1.5 RESPONSIBILITIES OF THE CONTRACTOR

A. In addition to the responsibilities and duties described on the Drawings and in the Specifications, Contractor shall also be responsible for
   1. Complying with all provision in the most current South Carolina Department of Health and Environmental Control (DHEC) regulations.
   3. Any and all fines and penalties that may be levied by DHEC applicable to site control, water management, dust and noise control, and other applicable pollution attributes.
   4. Providing all necessary and required controls as necessary above and beyond those indicated on the Drawings and described in the specifications for, but not limited to, the following:
      a. Silt
      b. Dust
      c. Noise
      d. Runoff
      e. Erosion
      f. Sediment
      g. Water management

B. The Contractor shall fully comply with all provisions of the Contract Documents including, but not limited to, providing and installing such entities as the products, materials, equipment, components, or systems that were proposed at the time bids were received. Except for extenuating circumstances as determined by the Office Of the State Engineer (OSE) and Architect, notification of not being able to meet any of the provisions of the Contract Documents or communicating conflicts in the Contract Documents to the Architect will not be considered after receipt of bids; and the Contractor shall fully comply with the Contract Documents at no increase in Contract Sum or Contract Time.

C. In addition to the responsibilities and duties described elsewhere in these documents, Contractor shall also be responsible to:

1. DHEC site environmental permits not already obtained by the Owner,
2. Arrange and coordinate a DHEC pre-construction meeting,
3. Comply with provisions in the most current DHEC regulations,
4. Maintain the site as stipulated in the approved DHEC permit,
5. Fines and penalties levied by DHEC applicable to site control, water management, dust and noise control, and other applicable pollution issues,
6. Site inspections and reporting,

1.6 COORDINATION

A. Schedule Work to expose areas subject to erosion for the shortest possible time.

B. Preserve natural vegetation beyond construction limits.

C. Locate temporary storage and construction buildings and route construction traffic to minimize soil disturbance and erosion.

PART 3 – EXECUTION

3.1 AIR POLUTION

A. Open Burning: On-Site burning is not permitted.

B. Dust Control. Contractor shall control dust throughout the contract period within the project area and at all other areas affected by the construction. This includes, but is not specifically limited to, paved and unpaved roads, haul roads, access roads, disposal sites, borrow pits, and material and equipment storage sites. Dust control measures may include, but are not limited to, wetting down disturbed earth surfaces or eliminating traffic across them, removing accumulations of dirt from paved areas by hand or mechanical means, and washing streets at the end of the work day. Such dust control measures shall be performed when required by the Architect or the controlling agency for streets and roadways.

3.2 NOISE AND WATER POLLUTION

A. Noise Pollution: : Avoid use of tools and equipment that produce noise above 85 dB at a distance of 25 feet. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site. If noise levels are above acceptable levels, erect sound barriers to control noise or conduct demolition during times that are less disturbing to the Owner or a combination of both.

B. Water Pollution The Contractor shall exercise every reasonable precaution throughout the construction period to prevent pollution of rivers, streams, and water impoundments. Pollutants such as chemicals, fuels, lubricants, asphalt, bitumen, concrete, grout, raw sewage, pesticides, herbicides, or any other harmful waste shall not be discharged into or alongside any watercourse, impoundment, or channel.

3.3 SEDIMENT AND EROSION CONTROL

A. General. The project is subject to periodic inspection during construction by the Owner, Architect, OSE, City, and DHEC.

B. Sediment and erosion control measures shall consist of required and necessary measures and procedures. Measures, as required to control sediment, erosion, and runoff, include, but are not limited to one or a combination of the following: control construction entrances, sediment basins/ponds/traps, diversion ditches and berms, erosion control matting, filter fabric silt fences, stone check dams, riprap outlet stabilization, inlet protection, and temporary fast-growing vegetation or other suitable groundcover, shall be used as necessary to control runoff and erosion. If the plan for controlling sediment and erosion proves ineffective, the Contractor shall add to, change, or revise the sediment and erosion control plan, approach, or measures to make them effective, and as directed by the Architect, Owner, OSE, DHEC, or City, or other local governing authorities. Costs for additional sediment and erosion control measures shall be the Contractor's responsibility. Effective sediment and erosion control will be a condition for recommendation of progress payment applications.

1. Methods. Provide sediment and erosion control practices and measures as required to prevent and control erosion.

2. Construction Entrances. Provide a gravel area or pad at all points where vehicles enter and leave a construction site. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade and place gravel to the grade and dimensions shown on the plans. Provide drainage to carry water to a sediment trap or other suitable outlet.

3. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2-inch stone. Contractor shall immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

4. Sediment Basins. Sediment basins designed to collect and detain sediment-laden storm water runoff and release, at a slower rate, a much cleaner, better quality water shall be constructed as shown on the drawings. If not shown on the Drawings, coordinate with the Architect.

5. Inspect sediment basins after each rainfall and remove accumulated sediment as required by the notes on the drawings. Any unusual or damaging situation shall be reported immediately to the Architect in writing within 24 hours of the incident.

6. Diversion Berms and Ditches. Temporary soil berms or ridges, excavated channels, or a combination berm and channel shall be constructed across sloping land as shown to protect work areas or existing storm drains from upslope runoff and/or to divert sediment-laden water to sediment basins or traps or stable outlets.

7. Provide sufficient room and diversions to permit machine regrading and cleanout. Permanent seeding including reuse of existing topsoil shall be provided after construction.

8. Inspect temporary diversions once a week and after every rainfall. Remove sediment from the flow area and repair the ridge. Provide a written report of any unusual or potentially damaging conditions to Architect within 24 hours of the incident.

9. When the protected area is permanently stabilized, the ridge and the channel shall be removed and blended with the natural ground level and seeding shall be provided.

C. Erosion Control Matting and Straw Blankets. Unless otherwise specified herein or noted on the drawings, jute and excelsior matting shall be placed where needed to aid in stabilizing disturbed areas. Jute or excelsior matting for erosion control shall not be dyed, bleached, or otherwise treated in a manner that will result in toxicity to vegetation.

1. Jute matting shall be of a uniform open plain weave pattern of single jute yarn, 48 inches in width, plus or minus 1 inch. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than one-half its normal diameter. There shall be 78 warp ends, plus or minus 2, per width of the matting; 41 weft ends, plus or minus 1, per linear yard; and the weight shall average 1.22 pounds per linear yard of the matting with a tolerance of plus or minus 5 percent.

2. Excelsior matting shall be wood excelsior, 48 inches in width plus or minus 1 inch, shall have a minimum thickness of 1/4 inch, and the weight shall average 1.07 pounds per linear yard of the matting with a tolerance of plus or minus 5 percent. The excelsior matting shall be covered on one side with a woven fabric consisting of either twisted paper cord or cotton cord having a minimum mesh size of 1 inch by 1 inch, and a maximum mesh size of 1-1/2 inch by 3 inches.

3. Unless otherwise specified herein or noted on the drawings, jute or excelsior matting may be installed where it is needed to prevent erosion and aid in stabilization of seeded areas and channels. Matting shall be placed immediately following seeding (seeding shall precede installation of matting). The ground surface shall be smooth and free from stones, clods, or debris which will prevent the contact of the matting with the soil. Matting shall be installed in accordance with the details indicated on the drawings and in accordance with the manufacturer's recommendations.

4. Erosion control straw blankets shall be provided on all seeded slopes, 3 horizontal to 1 vertical and steeper. The erosion control straw blankets shall be constructed of 100 percent agricultural straw and lightweight, photodegradable, polypropylene top and bottom nets. The approximate weight of the top and bottom nets shall be 1.64 pounds per 1,000 square feet. The approximate weight of the straw fiber shall be approximately 0.5 pound per square yard. The erosion control straw blankets shall be Landlok 407GR as manufactured by Synthetic Industries, Inc. and installed in accordance with the manufacturer's recommendations.

D. Silt Fence. Comply with ASTM D6461-Standard Specification For Silt Fence Materials
1. Materials
   a. Fabric: Fibers used in the manufacture of geotextiles for silt fence, and the threads used in joining geotextiles by sewing, shall consist of long-chain synthetic polymers composed of at least 95 % by weight of polyolefins or polyester. They shall be formed into a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.
   b. Posts: Wood, steel, or synthetic support posts having a minimum length of 3.3 ft plus the burial depth may be used. They shall be of sufficient strength to resist damage during installation and to the support applied loads due to material build up behind the silt fence.
   c. Wire or polymer support fence shall be at least 2.5 ft high and strong enough to support applied loads. Polymer support fences shall meet the same ultraviolet degradation requirements as the geotextile.
2. Construction:

a. The geotextile used for temporary silt fence may or may not be supported between posts with wire or polymeric mesh. Values for grab strength, permittivity, ultraviolet stability shall comply with the previously referenced ASTM D6461.
b. Minimum Height Above Ground: 2.5 ft.
c. Minimum Embedment Depth: 0.5 ft.
d. Post Spacing: Maximum post spacing is based on the fabric support or, if unsupported, on elongation as measured in accordance with Test Method D 4632 and as follows:
e. Supported Silt Fence: Maximum post spacing of 4 ft.
f. Unsupported Silt Fence With Elongation of 50% Or More: Maximum post spacing of 4 ft.
g. Unsupported Silt Fence With Elongation <50%: Maximum post spacing of 6.5 ft.

E. Stone Check Dams.

1. Small temporary stone dams constructed across drainage-ways draining 2 acres or less shall be constructed as shown to reduce flow velocity and minimize erosion in small channels.

2. Place stone on a synthetic filter fabric foundation as shown on the plans. Fabric shall be Mirafi 100 or equal providing puncture strength of 50 psi in accordance with ASTM D751.

3. Inspect check dams and channels for drainage after each runoff event. Contractor shall repair erosion and remove sediment at check dams. Stone shall be added to dams to maintain dimensions shown. Any unusual or damaging situation shall be reported immediately to the Architect in writing within 24 hours of the incident.

F. Temporary Sediment Traps.

1. Small, temporary ponding basins formed by an embankment shall be constructed as indicated on the drawings to detain runoff and trap sediment below drainage areas that are five (5) acres or less.

2. Clear, grub, and strip the area under the embankment of all vegetation, root mat, and top soil. Contractor shall place select fill for the embankment in 9 inch lifts and machine compact. Contractor shall overfill the embankment 6 inches to allow for settlement. Contractor shall construct a riprap spillway over Mirafi 100 or equal synthetic filter fabric. The spillway shall provide for flow discharge to an undisturbed, stable area.

4. Inspect traps after each rainfall and remove accumulated sediment when the depth exceeds one-half of the design depth. Contractor shall maintain the dimensions of the trap shown on the drawings using specified materials. Any unusual or damaging situation shall be reported immediately to the Architect in writing within 24 hours of the incident.

G. Outlet Stabilization.

1. Permanent riprap channels at the outlet of a lined channel or storm drain pipe shall be constructed as indicated on the drawings to reduce the flow velocity and dissipate energy.

2. Excavate and compact the outlet area to the density of the surrounding undisturbed material. Place filter fabric on the prepared subgrade as indicated on the drawings. Filter fabric shall overlap a minimum of one foot. Construct the riprap apron on a zero-percent slope with top elevation level with adjacent ground. Provide seeding of all disturbed areas adjacent to the riprap.

H. Inlet Protection. Temporary sediment barriers shall be constructed around storm drain inlets as shown on the drawings. Inspect structure after each rainfall and repair as required. Remove

sediment when trap reaches one-half capacity. Report any unusual or potentially damaging situations to Architect in writing within 24 hours of each incident.

I. Maintenance and Removal.

1. All sediment and erosion control devices or measures shall be implemented prior to any land-disturbing activity within the drainage area where they are located and in accordance with the construction sequence indicated on the drawings. Contractor shall periodically check sediment and erosion control measures and clean or otherwise remove silt build-up as necessary to maintain them in proper working order, all in accordance with the these specifications. All sediment and erosion control measures shall be maintained by the Contractor through final completion of the Work.

2. Noncompliance. Failure of the Contractor to comply with any of the preceding requirements may result in the Contractor receiving formal notification by DHEC to initiate such measures. If compliance is not forthcoming within 48 hours of receipt of notification, the Owner may suspend all or portions of the work pursuant to *South Carolina Storm Water Management and Sediment Control Regulations R.72-300*.

3.4 GENERAL HOUSEKEEEPING

A. Ensure that all vehicles and equipment have proper, functional, and operable mufflers and noise control apparatus.

B. To eliminate and control dust during and after site work activities, including demolition, water down grading and excavation areas, drives and roads, parking areas, and disturbed areas that can produce dust from any performed activity resulting from this Contract. Where demolition is a part of the Contract, the same dust and erosion controls apply to all structures being demolished. Perform as much demolition on calm days as possible without interfering with or compromising schedules.

C. Hose down trucks including cargo box, wheels, axels, and chassis to remove all dust and debris that may drop during transportation.

D. Cover all transport trucks with heavy duty tarps that completely enclose the cargo box. Tarps with holes or rips or that do not properly fit the cargo box are not acceptable. Ensure tarps are properly tied down to prevent flapping, fluttering, or blowing debris.

E. Ensure that no portion of debris is exposed or extends past any portion of the cargo box during transportation.

F. Clean up all trash and debris droppings on public and private property resulting from executing this Contact.

G. Repair all damage to public and private property including buildings, structures, landscaping, roads, and highways that results from executing this contract.

H. Keep vehicle windows clean for clear, proper, and safe visibility.

END OF SECTION 31 25 00

SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirements .

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

G. Record moisture content of soil before application.

H. Maintenance Data: Indicate re-treatment schedule .

I. Warranty: Submit warranty and ensure that forms have been completed in University of South Carolina's name.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of 2 years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in the State in which the Project is located.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
   1. Bayer Environmental Science Corp; Product ____: www.backedbybayer.com/pest-management.
   2. FMC Professional Solutions; Product Prevail: www.fmcprosolutions.com.
   3. Syngenta Professional Products; Product Probuild TC: www.syngentaprofessionalproducts.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Toxicant Chemical: EPA approved; synthetically color dyed to permit visual identification of treated soil.

C. Diluent: Recommended by toxicant manufacturer.

2.02 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. Masonry: Treat voids.
   3. At Both Sides of Foundation Surface.
   4. Soil Within 10 feet of Building Perimeter For at Depth recommended by manufacturer.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

1.2 RELATED SECTIONS

A. Section 32 12 16 – Asphalt Paving

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

B. South Carolina Department of Transportation Standard Specifications for Highway Construction, latest edition.

1.4 SUBMITTALS

A. Submit Documentation that Aggregate Base Course meets SCDOT Standard 305, latest specification.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base Course: Materials comply with SCDOT Specifications Section 305, Graded Aggregate Base Course. The composition mixture of course aggregate and binder material shall meet the grading requirements specified for Macadam base course.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sub grade has been inspected, proof rolled, and elevations are correct, and dry.

3.2 AGGREGATE PLACEMENT

A. Spread aggregate over prepared sub grade to a total compacted thickness as shown on plans.

B. Place aggregate in maximum 8-inch layers and roller compact.

C. Level and contour surfaces to elevations and gradients indicated.

D. Add small quantities of fine aggregate to course aggregate as appropriate to assist compaction.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.3 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from True Elevation: Within 1/2 inch.

D. Compaction shall be 100 percent of maximum density as required by ASTM D-1557.

3.4 FIELD QUALITY CONTROL

A. Compaction testing shall be performed at a minimum frequency of one test per lift per 2000 sq. feet of material placed within parking areas. Additionally, thickness measurements should be performed at a minimum of one measurement per lift per 5000 square feet of material placed. One bulk sample should be obtained per 1000 linear feet of roadway for gradation testing, per ASTM C136.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION 32-11 23

SECTION 32 12 16

HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. SCDOT Standard Specifications, 2007 edition.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Pavement-marking paint.

1.3 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. SCDOT: South Carolina Department of Transportation.

1.4 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of SCDOT.

1. Standard Specification: SCDOT Standard Specifications, latest edition.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification of approval of each job mix proposed for the Work and that it meets SCDOT Mix Design.

C. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by SCDOT.

B. Regulatory Requirements: Comply with SCDOT for asphalt paving work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
1. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement
2. Asphalt Surface Course: Minimum surface temperature of 50 deg F at time of placement and Season installation limitations as established by SCDOT.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg Ffor oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that are mandated by the SCDOT Standard Specifications, latest edition.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: per SCDOT Standard Specification, latest edition.

B. Asphalt Cement: per SCDOT Standard Specifications

C. Prime Coat: Asphalt emulsion prime complying with SCDOT requirements.

D. Tack Coat: per SCDOT Standard Specifications

E. Water: Potable.

2.3 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
   1. Base Course: SCDOT Sect. 305 Graded Aggregate Base
   2. Surface Course: SCDOT Type C Surface

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Coordinate proof roll in the presence of the Geotechnical engineer representative.

C. Proceed with paving only after unsatisfactory conditions have been corrected and approved by Geotechnical Engineer.

3.2 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that subgrade is prepared in accordance with SCDOT Specification section 208 and ready to receive base course.

   1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

3.3 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt in accordance with SCDOT Standard Specification 401.4.19.

3.4 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers. Ensure that compaction is obtained following the requirements stated in SCDOT Standard Specification SC-M-400 and Spec Section 401.4.20.

   1. Complete intermediate rolling before the mat temperature cools to 175 deg F.

B. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

C. Ensure that the surface of the HMA after compaction is smooth and true to the established crown and grade. Remove any mixture that becomes loose and broken, mixed with dirt, or in any way defective and replace it with fresh HMA. Immediately compact the fresh HMA to conform to the surrounding area.

D. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

E. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.5 JOINTS

A. Joints to be constructed according to SCDOT Specification 401.4.23, latest edition.

3.6 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Finished Surface to meet requirements of SCDOT Section 401.4.27.

3.7 PAVEMENT MARKING

A. Contractor to apply onsite (Non-SCDOT right-of-way) pavement markings in accordance with SCDOT Section 625, Fast Dry Waterborne Paint.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Subgrade: Contractor to perform proofroll as stated in Section 321123 on all prepared subgrades and Geotechnical Engineer to perform nuclear density test or equal to verify compaction requirements are met prior to base and asphalt surface installation.

G. Thickness: Geotechnical Engineer to witness all pavement placement operations and randomly check compacted thickness during installation. A minimum of one test per 5000 square feet of material placed should be conducted or a minimum of three tests per days paving operation.

H. In-Place Density: Testing agency will determine target asphalt density prior to asphalt placement in accordance with SCDOT Standard procedures. Prior to asphalt surface and

binder course placement, a roller pattern with randon density testing should be performed to establish the designated number and passes of the compaction equipment per lift of material.

1. Cores are to be obtained from the recently placed asphalt material for measurement purposes. The binder and/or surface should be cored at a minimum of one core per 5000 square feet of material placed or a minimum of five cores. The cores should be measured for thickness and bulk specific gravity (to calculate density), per ASTM C174 and D2726 respectively.

I. Bird Bath Tolerance: After paving operations are complete, inspect pavement after first substantial rainfall (0.5 inch plus) to inspect for depressions. If depression is found, where water ponds to a depth of 1/8" in more than 6 feet, fill or correct depression to provide proper drainage.

J. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 12 16

SECTION 32 13 13

CONCRETE SIDEWALK AND CURB AND GUTTER

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.

B. SCDOT Standard Specifications, Latest Edition.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Sidewalks
   2. Curbs and gutters.

B. Related Sections include the following:

   1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.

1.3 SUBMITTALS

A. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Perform Concrete Work in accordance with SCDOT Spec Section 720.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. SCDOT Qualified Manufacturer of Concrete. Batch and Mix concrete in accordance with SCDOT Section 701.

2.2 FORMS

A. Forms to be in accordance with SCDOT Standard Specification 720.4.2.

B. In lieu of wood or metal forms, curb may be placed by a curb extrusion or slip form machine. Construct expansion and contraction joints at the same locations as required when form construction is used. Make contraction joints, spaces at 10 ft intervals, by cutting the concrete with a trowel or by other means to ensure the joints has a workmanlike finish after edging.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: per SCDOT Standard Specification 701.2.1
2. Normal-Weight Aggregates: per SCDOT Standard Specifications SC-M-501.

B. Water: SCDOT Specification 701.2.11.

C. Air-Entraining Admixture: In accordance with SCDOT Specification 701.2.5.1.

2.4 CURING MATERIALS

A. Liquid membrane-forming compounds meeting the requirements of SCDOT Section 702.2.2.11.

2.5 CONCRETE MIXTURES

A. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength of Concrete Walks and Curbs and Gutters: 3000 psi minimum.

B. Add air-entraining admixture per SCDOT Specifications.

C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use plasticizing and retarding admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.6 CONCRETE MIXING AND PLACING

A. Batch and mix the concrete in accordance with SCDOT Section 701.

B. Construct concrete curbs and curb and gutter in uniform 10 ft. sections, except where shorter sections are necessary for closure. Ensure that no section is less than 4 feet. Separate the sections by sheet steel templates or dividing plates set normal to the face and top of curb. Carefully set the plates during the placing of concrete and keep in place until the concrete has set sufficiently to hold its shape. Remove the plates while the forms are still in place.

C. Deposit concrete in forms so that the forms do not displace out of grade or alignment. During placing operations, spade or vibrate the concrete throughout the entire mass and especially against forms and joints. Tamp, float, trowel, broom, edge, and finish the surface of the concrete to the typical section, lines, and grades as soon as practicable after the placing of concrete.

D. Extruded or Slip Form Curb may be used in lieu of wood or metal forms. Construct expansion and contraction joints at the same locations as required when form construction is used. Make contraction joints, spaces at 10 ft intervals, by cutting the concrete with a trowel or by other means to ensure the joints has a workmanlike finish after edging.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

3.2 PREPARATION

A. Thoroughly compact the subgrade and finish to a smooth, firmly compacted surface, which is moist at the time the concrete is placed. In areas where it is impractical to use standard type rollers, compact by vibratory hand compactors. Remove and replace any concrete that settles or cracks after placement due to poor compaction at no expense to the Owner.

3.3 JOINTS

A. Expansion Joints: Ensure that preformed expansion joints are ¾ inch thick and extend the full depth of the concrete. Construct joints at the following locations:
   1. Wherever a sidewalk is constructed between an adjoining structure on one side and curbing on the other side, form an expansion joint adjacent to the curbing.
   2. Place an expansion joint between the sidewalk and the radius curbing at street intersections.
   3. Where existing structures such as light poles, bases, fire hydrants, etc. are within the limits of sidewalk or curb.
   4. Where concrete sidewalks are constructed adjacent to existing or new concrete pavement or structures, place a transverse expansion joint in the sidewalk opposite such joints in the concrete pavement or structure.
   5. Place expansion joints at intervals of not more than 100 feet in all concrete.

B. Contraction Joints:
   1. Divide concrete slabs in sidewalks between expansion joints into blocks 10 feet in length, by scoring transversely after floating operations are complete. Where the sidewalk slabs are more than 10 feet in width, score them longitudinally in the center. Extend transverse and longitudinal scoring for a depth of 1 inch and not less than ¼ inch or more than ½ inch in width. Edge and finish joints smooth and true to line.
   2. Form weakened-plane contraction joints, sectioning concrete into areas as indicated above for curb and gutter.

C. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.4 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Protect the concrete as specified in SCDOT Section 702.4.6 and cure with liquid membrane-forming compound meeting the requirements of SCDOT Section 702.2.2.11.

3.5 BACKFILLING

A. After the concrete has set sufficiently and the forms have been removed, backfill the curb on both sides to the required elevation with suitable material that is firmly compacted and neatly graded. Backfill concrete gutter sot that earth material is a minimum 1 inch above the concrete. Maintain an earth roll on each side as necessary to prevent undermining of curb and gutter.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports. Testing agency to perform compressive concrete strength testing in accordance with SC-T-50.

B. Test results shall be reported in writing to Engineer, 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.

C. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, compressive strengths, or other requirements have not been met, as directed.

D. Remove and replace concrete pavement 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.

3.7 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32-1314

PORTLAND CEMENT CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes furnishing of all labor, materials, equipment and related items required to complete all concrete work as shown or scheduled on the Drawings and specified herein. Items include, but are not necessarily restricted to the following:
   1. Concrete paving.
   2. Concrete footing.
   3. Concrete curbing.
   4. Expansion joints.
   5. Control joints.

1.02 QUALITY ASSURANCE:

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

PART 2 - PRODUCTS

2.01 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct form work for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

B. Reinforcing Materials:

   Reinforcing Bars: ASTM A 615, Grade 60, deformed.

C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.

2.02 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to Landscape Architect. Use one brand of cement throughout project, unless otherwise acceptable to Landscape Architect.

B. Course Aggregates: ASTM C 33, and as herein specified with maximum size No. 57. Provide aggregates from a single source for exposed concrete. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Landscape Architect.

C. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

D. Water: Potable.

E. Air-Entraining Admixture: ASTM C 260.

F. Calcium Chloride: will not be permitted in concrete.

G. Chemical Curing Compound and Hardener: Symons Corporation Cure and Hard.

2.03 JOINT MATERIAL:

A. Expansion Joint Material: shall be asphalt mastic strips (Pre-formed) composed of cane fiber of cellular nature, or other suitable and approved fiber impregnated with a durable asphaltic compound. Install where located on plans. Hold top edge 1/2" from surface. Thickness throughout to be 1/2".

B. Construction Joints: Shall be tongue and groove. Provide removable screed cap to from 1/2" x 1/2" groove above joint material. (Caulk joint to within 1/8" of surface).

2.04 PROPORTIONING AND DESIGN OF MIXES:

A. Admixtures: Air entrainment agents conforming to ASTM C-260 shall be used in concrete exposed to weather, and may be used in all concrete on this project. Air entraining admixtures shall be used to produce 3% to 6% air by volume in the concrete.

2.05 CONCRETE STRENGTHS AND SLUMPS:

A. Strength: All cast-in-place concrete shall have a minimum strength at 28 days (ultimate strength) of 3000 PSI.

B. Proportioning of the Concrete Mixture:

1. The proportion of the aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface.

2. The materials used for the concrete shall be measured by weight. Maximum slump shall be 4".

2.06 CONCRETE MIXING:

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to the batch will not be permitted. During hot weather, or under conditions contributing to rapid setting concrete, a shorter mixing time than specified in ASTM C 94 may be required.

B. When air temperature is between 85° F (30° C) and 90° F (32° C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90° F (32° C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMS:

A. Design, erect, support, brace and maintain form work to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design form work to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like to prevent swelling and for easy removal.

3.02 SUBGRADES FOR PAVING:

A. Grading: Do any necessary grading in addition to that performed under work of Section 02200 to bring subgrades for paving after final completion to the required grades and sections.

B. Preparation of Subgrade: Loosen exceptionally hard spots and recompact. Remove spongy and otherwise unsuitable material and replace with stable material. Fill and tamp traces of utility trenches.

C. Compaction of Subgrade: Compact the subgrade of all surface areas with appropriate compacting equipment or by other means to such degree as will insure against settlement of the superimposed work.

D. Checking Subgrade: Maintain all subgrades in satisfactory condition, protected against traffic and properly drained until the surface improvements are placed. Immediately in advance of concreting, check subgrade levels with templates riding the forms, correct irregularities and compact thoroughly any added fill material. On areas to receive concrete pavement, place grade stakes spaced sufficiently to afford facility for checking subgrade levels. Correct irregularities prior to concreting.

E. Utility Structures: Check for correct elevation and position all manhole covers, drainage castings, valve boxes and similar items located within areas to be paved and make or have any necessary adjustments.

3.03 PLACING REINFORCEMENT:

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and method of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by form work, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least maximum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.04 JOINTS:

A. Expansion Joints: Shall be provided where shown and as detailed on the Drawings or specified and shall be at right angles to the slab and extend for the full depth of the pavement. Round all edges of pavement at expansion joints to a 1/8" radius by tooling uniformly with a sidewalk tool.

B. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Landscape Architect.

C. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

D. Isolation Joints in Slabs-on-Ground: Construction joints in slabs on ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

E. Control Joints in Slabs-on-Ground: Construct control joints in slabs on ground to form panels of patterns as shown. Joints to be 1" min depth.

3.05 PREPARATION OF FORM SURFACES:

A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel form work is not acceptable.

3.06 CONCRETE PLACEMENT:

A. Preplacement Inspection: Before placing concrete, inspect and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where coatings are not used.

B. Coordinate the installations of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. General: Comply with ACI 304, and as herein specified.

D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified. When air temperature has fallen to or is expected to fall below 40° F, uniformly heat water and aggregate before mixing to obtain a concrete mixture temperature of not less than 50° F, and not more than 80° F at point of placement.

F. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

G. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

H. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90° F (32° C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.
   2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
   3. Wet forms thoroughly before placing concrete.
   4. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.07 CONCRETE FINISH:

A. All concrete surfaces to receive a light broom finish.

3.08 CONCRETE CURING, HARDENING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive hot or cold temperatures.

B. Method: Membrane cure-hardener applied to all slabs as follows:

   1. Apply membrane cure-hardener to concrete surfaces by spray, brush or roller. Apply as soon as the concrete is dry to the touch or immediately after finish troweling. Keep slab free of traffic for 48 hours after application. Follow manufacturer's instructions.

3.09 CONCRETE SURFACE REPAIR:

A. Patching Defective Formed Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Landscape Architect.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Before placing cement mortar or proprietary patching compound, thoroughly clean, dampen with water and brush-coat. They are to be patched with neat cement grout, or proprietary bonding agent.

C. Repair defective slab surfaces by removing and replacing with fresh concrete. Remove entire section between nearest scores. Finish and apply curing-hardener work. Re-joint scores.

3.10 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. The Contractor will employ a testing laboratory to perform tests and to submit tests reports. Sampling and testing for quality control placement of concrete may include the following as directed by Landscape Architect.

B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

C. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one test of each set of compressive strength test specimens.

D. Compression Test Specimen: ASTM C 31; one set of 6 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

E. Compressive Strength Tests: ASTM C 39; one set for each 100 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq.ft. of surface area placed; 2 specimens tested

at 7 days, 3 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

F. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used. When total quantity of a given class of concrete is less than 50 cu. yds. strength test may be waived by Landscape Architect if, in his judgment, adequate evidence of satisfactory strength is provided. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

G. Test-results will be reported in writing to Landscape Architect and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete placement, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

H. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained as directed by Landscape Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 32 13 43

PERVIOUS CONCRETE PAVEMENT

PART 1—GENERAL

1.1—SCOPE

A. This Specification provides requirements for the construction of pervious concrete pavement. In case the requirements of this Specification conflict with the Contract Documents, the Contract Documents shall govern.

1.2—DEFINITIONS

Architect/Engineer—the architect, engineer, architectural firm, or engineering firm issuing Contract Documents or administering the Work under Contract Documents, or both.
Contract Documents—a set of documents supplied by the Owner to the Contractor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.
Contractor—the person, firm, or entity under contract for construction of the Work.
early-entry dry-cut saw—a tool designed to produce joints in concrete commencing 1 to 4 hours after finishing and without raveling the cut edges.
exposure condition, moderate—an environment, normally in temperate climate regions, in which concrete will only occasionally be exposed to moisture and will not be saturated before freezing and where no deicing agents or other aggressive chemicals are used.
exposure condition, severe—an environment, normally in cold climate regions, in which concrete may be saturated or in almost continuous contact with moisture before freezing, and where deicing agents are used.
joint, construction—the surface where two successive placements of concrete meet, across which it may be desirable to achieve bond, and where the first has undergone final set before the next placement.
joint, contraction—formed, sawed, or tooled groove in a concrete structure to create a weakened plane to regulate the location of cracking resulting from the dimensional change of different parts of the structure.
joint, isolation—a normally vertical interface allowing relative movement without transferring sufficient tension, compression, or traction forces to negatively affect the performance of a structure or pavement.
Owner—the corporation, association, partnership, individual, public body, or authority for whom the Work is constructed.
panel—a concrete element that is relatively thin with respect to other dimensions and is bordered by joints or edges.
pavement, pervious—a pavement comprising material with sufficient continuous voids to allow water to pass from the surface to the underlying layers.
permitted—accepted or acceptable to the Architect/Engineer, usually pertaining to a request by Contractor, or when specified in Contract Documents.
Project Drawings—graphic presentation of project requirements.
Project Specification—the written document that details requirements for the Work in accordance with service parameters and other specific criteria.
reference standards—standardized mandatory language documents of a technical society, organization, or association, including the building codes of local or state authorities, which are referenced in the Contract Documents.

subbase—a layer in a pavement system between the subgrade and the base course, or between the subgrade and a portland-cement concrete pavement.
subgrade—the soil prepared and compacted to support a structure or a pavement system.
submittal—document or material provided to the Architect/Engineer for review or acceptance.
Work—the entire construction or separately identifiable parts thereof required to be furnished under Contact Documents.

1.3—REFERENCED STANDARDS

A. Standards of ACI and ASTM referred to in this specification are listed with serial designation including year of adoption or revision, and are part of this specification.

1.4—STANDARDS-PRODUCING ORGANIZATIONS

Abbreviations for and complete names and addresses of organizations issuing documents referred to in this specification are listed:

American Concrete Institute (ACI)
P.O. Box 9094
Farmington Hills, MI 48333-9094
www.concrete.org

ASTM International (ASTM)
100 Barr Harbor Drive
West Conshohocken, PA 19428
www.astm.org

National Ready Mixed Concrete Association (NRMCA)
900 Spring Street
Silver Spring, MD 20910
www.nrmca.org

1.5—SUBMITTALS

A. Contractor shall submit drawings and documentation as required in this specification for acceptance by the Architect/Engineer.

B. Obtain written acceptance of submittals before using the materials or methods requiring acceptance.

C. *Responsibility of Contractor*—Before construction, submit to Architect/Engineer:

1. Qualifications of Contractor related to construction of pervious concrete pavements.
2. Proposed concrete mixture proportions and density.
3. When required by the Architect/Engineer, in-place pavement test results from previous Work, completed in the last 12 months, including design void content, density, and concrete mixture proportions.
4. Two test panels, as described in 1.6.2, placed, jointed, and cured; each a minimum of 225 ft2 (20.9 m2) and having the required thickness defined by Contract Documents.

1.6—QUALITY CONTROL

A. *General*—Test and inspect concrete materials and operations as Work progresses as described in 1.6.5. Failure to detect defective Work or material early will not prevent rejection if a defect is discovered later, nor shall it constitute final acceptance.

1. *Contractor qualification*—The Contractor shall employ no less than one National Ready Mixed Concrete Association (NRMCA) certified pervious concrete craftsman who must be on site, overseeing each placement crew during all concrete placement, or the Contractor shall employ no less than three NRMCA certified Pervious Concrete Installers, who shall be on site working as members of each placement crew during all concrete placement, or the Contractor shall employ no less than five NRMCA certified Pervious Concrete Technicians, who shall be on site working as members of each placement crew during all concrete placement unless otherwise specified. Alternative documentation of qualifications shall be permitted when approved by the Architect/Engineer.
2. *Concrete Producer qualification*-The Contractor shall use a concrete producer who has successfully produced Pervious Concrete on a minimum of three successful projects.

B. *Test panels*—Test panels shall be placed using the mixture proportions, materials, and equipment as propose for the project. Test panels, if acceptable, may be incorporated into the project. Test density of fresh concrete for the test panels in accordance with ASTM C138/C138M following the consolidation procedures described in ASTM C29/C29M, Jigging Procedure. Core hardened concrete for the test panels in accordance with ASTM C42/C42M, test thickness in accordance with ASTM C174/C174M, and test density in accordance with ASTM C140, Paragraph 9.3.

1. Fresh density shall be within ±5 lb/ft3 (80 kg/m3) of the specified fresh density.
2. Tolerance for thickness and density reported as the average of three cores of each test panel shall be as follows:
    a. The average compacted thickness shall not be more than 1/4 in. (6 mm) less than the specified thickness; nor shall the average compacted thickness be more than 1-1/2 in. (38 mm) more than the specified thickness.
3. When a test panel is outside one or more of the limits of 1.6.2.1 and 1.6.2.2, the test panel shall be rejected, removed, and replaced at the Contractor's expense.
4. When the test panel complies with 1.6.2.1 and 1.6.2.2, the panel may be left in place and included in the completed Work.

C. *Testing agencies*—Agencies that perform testing services on concrete materials shall meet the requirements of ASTM C1077. Agencies inspecting the Work shall meet the requirements of ASTM E329. Owner shall employ the testing agency.

1. Field tests of concrete required in 1.6.4 shall be performed by an individual certified as both an NRMCA Certified Pervious Concrete Technician or equivalent and an ACI Concrete Field Testing Technician—Grade 1 or equivalent.

D. *Testing responsibilities of Contractor*

1. Advise the Architect/Engineer at least 48 hours before concrete placement.

E. *Testing*

1. Obtain a minimum 1 ft3 (28 L) sample for acceptance tests in accordance with ASTM C172. Measure a minimum of one density test during each day's placement in accordance with C138/C138M following the consolidation procedures described in ASTM C29/C29M, Jigging Procedure. Determine density using a minimum 0.25 ft3 (0.007 m3) cylindrical metal measure. Fill and compact the measure in accordance with ASTM C29/C29M, Jigging Procedure.

2..a Fresh density shall be within ±5 lb/ft3 (80 kg/m3) of the specified fresh density.
3. Remove three cores from each lot of 5000 ft2 (450 m2), in accordance with ASTM C42/C42M, not less than 7 days after placement of the pervious concrete. Cores shall be a minimum nominal 4 in. (100 mm) diameter. Select three locations in accordance with ASTM D3665. Measure the cores for thickness (ASTM C42/C42M) and density (ASTM C140). After thickness determination, trim and measure the cores for density in the saturated condition as described in Paragraph 9.3, Saturation, of ASTM C140. Immerse the trimmed cores in water for 24 hours, drain for 1 minute, remove surface water with a damp cloth, then weigh immediately.

a. Tolerance for thickness and density reported as the average of three cores of each lot shall be as follows:

b. The compacted thickness shall not be more than 1/4 in. (6 mm) less than the specified thickness, with no single core exceeding 1/2 in. (13 mm) less than the specified thickness; nor shall the average compacted thickness be more than 1-1/2 in. (38 mm) more than the specified thickness.

c. Hardened density shall be within ±5% of the approved hardened density from the test panels.

d. When a lot is outside one or more of the limits of 1.6.5.2.1, the lot shall be subject to rejection, removed, and replaced at the Contractor's expense unless accepted by the Owner.

4. Core holes shall be filled with concrete or preblended grout.

PART 2—PRODUCTS

2.1—SUBBASE

Coarse aggregate base material shall meet the size and grading requirements of ASTM No. 5 Stone.

2.2 – GEOTEXTILE (FILTER FABRIC)

a. Contractor to line perimeter of stone base with a non-woven geotextile to prevent fines in the subgrade from migrating into the stone bed. Acceptable geotextiles are as follows:
   1) Mirafi 140N
   2) Amoco 4547
   3) Geotex 451, or approved equal

2.3—PERVIOUS CONCRETE

Comply with ASTM C94/C94M and the following requirements:

A. *Aggregates*—Nominal maximum aggregate size shall not exceed 1/3 of the specified pavement thickness. Use coarse aggregate (3/8 to No. 16) per ASTM C 33 or No. 89 coarse aggregate (3/8 to No. 50) per ASTM D 448.

B. *Admixtures*—Chemical admixtures that facilitate the production and placement of pervious concrete shall be permitted. The use of such admixtures shall be notified to the Architect/Engineer. Type A Water Reducing Admixture, Type B Retarding, Type D Water Reducing/Retarding – ASTM C 494.

C. *Fibers*—The use of fibers in pervious concrete mixtures is permitted when approved by the Architect/Engineer.

D. *Air Entraining Agent* – Shall comply with ASTM C 260.

E. *Cement:* Portland Cement Type I or II conforming to ASTM C 150 or Portland Cement Type IP or IS conforming to ASTM C 595, or ASTM C 1157.

F. *Water:* Comply with ASTM C 94.

2.3—ISOLATION JOINT MATERIAL

A. For isolation joint materials, comply with ASTM D994, D1751, or D1752.

2.4—FORMS

A. Make forms with steel, wood, or other material that is sufficiently rigid to maintain specified tolerances, and capable of supporting concrete and mechanical concrete placing equipment.

B. Forms shall be clean and free of debris of any kind, rust, and hardened concrete.

2.5 – MIX PROPORTIONS

A. Cement Content: For pavements subjected to vehicle traffic, the total cementitious material content shall not be less than 600 lbs per cu.yd.

B. Aggregate Content: The volume of aggregate per cu.yd shall be a minimum 18 cu ft. when calculated as a function of unit weight determined in accordance with ASTM C 29 jigging procedure. Fine aggregate, if used, should not exceed 3 cu.ft. and shall be included in the total aggregate volume.

C. Admixtures: Shall be used in accordance with the manufacturers instructions and recommendations.

D. Mix Water: Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate. Insufficient water results in inconsistency in the mix and poor bond strength. High water content results in the past sealing the void system primarily at the bottom and poor surface bond.

E. Mix Design: High porosity, low strength Modulus of Rupture shall be as follows:

- Average strength such that at least 90% of tests are equal to or greater than 150 psi.
- Any individual test (minimum of 2 beams) shall be greater than 130 psi.
- Modulus of Rupture tests shall be in accordance with AASHTO T 23, and T97, except beams shall be filled in one lift (1 layer), compacted lightly during filling, and finished by rolling a hardened 6”x12” concrete sample across its surface and tested at 14 days. Unit weight (density) and % voids (porosity) shall be tested and reported.

PART 3—EXECUTION

3.1—SUBGRADE PREPARATION

A. Excavate to subgrade to ensure that the required pavement thickness is obtained in all locations.

C. Keep all traffic off of the subgrade during construction to the maximum extent practical. Regrade and recompact subgrade disturbed by concrete delivery vehicles or other construction traffic, as needed.

D. Compact the material added to obtain final subgrade elevation. The subgrade shall be compacted by a mechanical vibratory compactor to a minimum density of 92% of a maximum dry density as established by ASTM D 1557 or AASHTO T 180. If fill material is required to bring the subgrade to final elevation, it shall be clean and free of deleterious materials. It shall be placed in 8 inch lifts, and compacted by a mechanical vibratory compactor to a minimum density of 92% of maximum dry density. The subgrade shall be in a moist condition (within +/- 3% of the optimum moisture content as determined by the modified compaction test ASTM D 1557.)

E. Determine subgrade permeability in accordance with ASTM D3385 before concrete placement. Confirm that subgrade permeability meets requirements of Contract Documents.

3.2—SUBBASE

A. Following subgrade prep, Immediately install filter fabric over the extent of stone bed. Overlap the filter fabric a minimum of 16 inches. Fabric to extend at least four feet outside the bed so that it can be folded over the bed to temporarily protect it until the surface is placed.

B. Place aggregate for the stone recharge bed, taking care not to damage the filter fabric. Aggregate should be dumped at the edge of the bed and place in layers of 8 to 12 inches using track equipment. Compact each lift with a single pass of a light roller or vibratory plate compactor.

3.3—SETTING FORMWORK

A. Set, align, and brace forms so that the hardened pavement meets the tolerances specified in 3.9.

B.Apply form release agent to the form face, which will be in contact with concrete, immediately before placing concrete.

C. The vertical face of previously placed concrete may be used as a form.

D. Protect previously placed pavement from damage.

E. Do not apply form release agent to previously placed concrete.

F. Placement width shall be as specified in Contract Documents. Concrete placement width shall not exceed 20 ft (6 m) unless otherwise specified.

3.4—BATCHING, MIXING AND DELIVERY

A. Batch and mix in compliance with ASTM C94/C94M except that discharge shall be completed within 60 minutes of the introduction of mixture water to the cement. Increase time to 90 minutes when using an extended set control admixture. Water addition is permitted at the point of discharge.

B. Mix Time – Truck Mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.

3.5—PLACING AND FINISHING FIXED-FORM PAVEMENT

A. Deposit concrete either directly from the transporting equipment or by conveyor onto the prewetted subgrade or subbase, unless otherwise specified.

B. Do not place concrete on frozen subgrade or subbase.

C. Deposit concrete between the forms to an approximately uniform height.

D. Spread the concrete using a come-along, short-handle, square-ended shovel, or rake.

E. Do not allow foot traffic on the fresh concrete.

F. Contractor shall provide mechanical equipment of either slip form or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force. The pavement will be placed to the required cross section and shall not deviated more than +/- 3/8 inch in 10 feet from design grade. If placing equipment does not provide the minimum specified vertical force, a full width roller or other full width compaction device that provides sufficient compactive effort shall be used immedialy following the strike off operation. After mechanical or other approved strike off and compaction operation, no other finishing operation shall be allowed. The Contractor will be restricted to pavement placement widths of a maximum of fifteen feet.

G. Do not use steel trowels or power finishing equipment.

H. Finish the pavement to the elevations and thickness specified in Contract Documents and meet the requirements of 3.9.

3.6—PLACING AND FINISHING SLIPFORM PAVEMENT

A. Slipform equipment is permitted.

B. Deposit and finish concrete in accordance with 3.5, except 3.5.4 and 3.5.6.

3.7—FINAL SURFACE TEXTURE

A. Compact fresh concrete to stay within the requirements of 3.9.

B. Compact the concrete along the slab edges with hand tools.

C. Compact concrete to a dense, pervious surface.

3.8—EDGING

A. Edge top surface to a radius of not less than 1/4 in. (6 mm).

3.9—TOLERANCES

A. Construct pavement to comply with the following tolerances:
Elevation: +3/8 in. (+19 mm), –0 in. (–0 mm)
Thickness: +1-1/2 in., –1/4 in. (+38 mm, –6 mm)
Contraction joint depth: +1/4 in. (6 mm), –0 in. (–0 mm)

B. Mechanically sweep pavement before testing for compliance with tolerances.

3.10—CURING

A. Begin curing within 20 minutes of concrete discharge.

B. Completely cover the pavement surface with a minimum 6 mil (0.15 mm) thick polyethylene sheet. Cut sheeting to a minimum of a full placement width.

C. Cover all exposed edges of pavement with polyethylene sheet.

D. Secure curing cover material without using dirt.

E. Cure pavement for a minimum of 7 uninterrupted days, unless otherwise specified. Do not allow traffic for 7 days.

3.11—HOT AND COLD WEATHER CONSTRUCTION

A. When hot weather is anticipated, submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during hot weather.

B. In cold weather, comply with ACI 306.1, recording concrete temperature no less than twice per 24-hour period.

3.12—JOINTING

A. Unless otherwise specified, construct joints at the locations, depths, and with horizontal dimensions indicated in Contract Documents.

B. When jointing requirements are not indicated on the Project Drawings, submit drawings describing proposed jointing in accordance with 1.4 and the requirements of 3.12.2.1 through 3.12.2.9. Do not proceed with Work until the jointing requirements are accepted by the Architect/Engineer.

1. Indicate locations of contraction joints, construction joints, and isolation joints. Spacing between contraction joints shall not exceed 20 ft (6 m).

2. The larger horizontal dimension of a slab panel shall not exceed 125% of the smaller dimension.

3. The angle between two intersecting joints shall be between 80 and 100 degrees, as specified in Contract Documents.

4. Joints shall intersect pavement free edges at 90-degree angles and shall extend straight for a minimum of 1-1/2 ft (0.5 m) from the pavement edge where possible.

5. Align joints of adjacent pavement panels.

6. Align joints in attached or adjacent curbs within 1/4 in. (6 mm) of joints in pavement.

7. Contraction joint depth shall be 1/4 of the pavement thickness. Minimum joint width for saw-cutting is 1/8 in. (3 mm). When using an early-entry dry-cut saw, the depth of the cut shall be at least 1 in. (25 mm).

8. Use isolation expansion joints only where pavement abuts fixed objects, such as buildings, foundations, and manholes.

9. Extend isolation joints through the full depth of the pavement. Fill the entire isolation joint with isolation joint material.

C. Create contraction joints by one of the following methods:

1. Tool contraction joints to the specified depth and width in fresh concrete immediately after the concrete is compacted.

2. Sawcut concrete after concrete has hardened sufficiently to prevent aggregate from being dislodged and soon enough to control pavement cracking. To minimize drying, ensure that curing materials are removed only as needed to make cuts.

3.13—OPENING TO TRAFFICE

A. Do not open the pavement to vehicular traffic until the concrete has cured for at least 7 uninterrupted days and until the pavement is accepted by the Architect/Engineer for opening to traffic.

3.14 – TESTING AND ACCEPTANCE

A. Laboratory Testing: The owner will retain an independent testing laboratory. The testing laboratory shall conform to the applicable requirements of ASTM E 329 “Standard Practice for Inspection and testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction” and ASTM C 1077 “Standard Practice for Testing Concrete and Concrete Aggregates for use in Construction, and Criteria for Laboratory Evaluation” and shall be inspected and accredited by the Construction Materials Engineering Council, Inc. or by an equivalent recognized national authority.

The Agent of the testing laboratory performing field sampling and testing of concrete shall be certified by the American Concrete Institute as Concrete Field Testing Technician Grade I, or by a recognized state or national authority for an equivalent level of competence. The Concrete Producer shall endorse technicians testing proficiency of Portland Cement Previous Concrete.

B. Testing and Acceptance: A minimum of 1 gradation test of the subgrade is required every 5000 square feet to determine percent passing the No. 200 sieve per ASTM C 117.

A minimum of one test each day’s placement of pervious concrete in accordance with ASTM C 172 and ASTM C 29 to verify unit weight shall be conducted. Delivered unit weights are to be determined in accordance with ASTM C 29 using a 0.25 cubic foot cylindrical metal measure. The measure is to be filled and compacted in accordance with ASTM C 29 paragraph 11, jigging procedure. The unit weight of the delivered concrete shall be ± 5 pcf of the design unit weight.

Test panels shall have two cores taken from each panel in accordance with ASTM C 42 at a minimum of seven (7) days after placement of the pervious concrete. The cores shall be measured for thickness, void structure and unit weight. Untrimmed, hardened core samples shall be used to determine placement thickness. The average of all production cores shall not be less than the specified thickness with no individual core being more than ½ inch less than the specified thickness. After thickness determination, the cores shall be trimmed and measured for unit weight in the saturated condition as described in paragraph 6.3.1 ‘Saturation’ of ASTM C 140 “Standard Methods of Sampling and Testing Concrete Masonry Units”. The trimmed cores shall be immersed in water for 24 hours, allowed to drain for one (1) minute, surface water removed with s damp cloth, then weighted immediately. Range of satisfaction unit weight values is ± 5 pcf of the design unit weight.

After a minimum of 7 days following each placement, three cores shall be taken in accordance with ASTM C 42. The cores shall be measured for thickness and unit weight determined as described above for test panels. Core holes shall be filled with concrete meeting the pervious mix design.

In lieu of cores a Pave Quality Indicator (PQI), manufactures by Trans Tech Systems, Inc. can be used to determine the density and porosity (quality) of in place Pervious Concrete Pavement.

END OF SECTION

SECTION 321400

UNIT MASONRY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Extent of each type of masonry work is included on drawings.
   1. Concrete block masonry.
   2. Face brick masonry.
   3. Brick paver.

1.02 QUALITY ASSURANCE:

A. Single Source Responsibility for Masonry Units: All masonry units to be used will be obtained from one source for each individual type of masonry.

B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

C. Sampler for Verification Purposes: Use existing brick sign walls at Cancer Survivor Garden as an example of representative workmanship.

PART 2 - PRODUCTS

2.01 BRICK AND BLOCK:

A. Concrete block (CMU).

B. Face Brick – Caledonia by Carolina Ceramics or Olde English by Boral Brick.

C. Paver brick – Pathway Full Range by Pine Hall or Heartland Flashed Beveled Edge by Boral Brick

2.02 MORTAR BRICK:

A. Portland Cement: ASTM C150, Type I, except Type III may be used to reduce protection requirements specified for laying masonry in cold weather. Provide cold cement required to produce the required mortar color.

B. Masonry Cement: ASTM C71.

C. Hydrated Lime: ASTM C207, Type S.

D. Sand: ASTM C144 for mortar and C404 for grout.

E. Water shall be clean and free of deleterious materials.

PART 3 - EXECUTION

3.01 MORTAR:

A. All mortar shall be Savannah Ivory by Argos ro approved equal

B. All masonry shall be thoroughly mixed in clean mortar boxes or an approved type of mechanical mixer with the dry materials being mixed to a uniform color before adding mixing water. The sand and cement shall be mixed in proportions to produce gray Type "S" mortar as recommended by the manufacturer of the cement used, but in no case shall the proportion of sand exceed 3 times the amount of cement used per batch.

3.02 MASONRY:

A. Masonry: All masonry work shall be laid by skilled masons, with all horizontal courses straight and level and all corners square and vertical surfaces straight and plumb. All masonry shall be laid in full beds of mortar with the head joints well filled.

B. The bond shall be common running bond for brickwork and concrete masonry units. Joints shall be properly broken and bond maintained throughout the entire work. Joints shall match existing wall joints in appearance. All masonry work shall be laid in a true workmanlike manner.

C. Lay out bond in exposed work and adjust so that no course terminates at a corner or opening with less than 1/2 of a unit. Use masonry saw for cutting masonry units where required. Use lapped sections for reinforcing at all wall intersections.

D. Cleaning Masonry Work: Clean all exposed masonry work after mortar has thoroughly set and cured. Directions of the manufacturer of the cleaning agent used shall be strictly adhered to.

END OF SECTION

SECTION 32 32 23

SEGMENTAL RETAINING WALLS

PART 1: GENERAL

1.1 Description

A. Work shall consist of furnishing and construction of a Segmental Block Retaining Wall System or equal in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans.

B. Work includes preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the lines and grades shown on the construction drawings.

C. Work includes furnishing and installing geogrid soil reinforcement of the type, size, location, and lengths designated on the construction drawings.

1.2 Related Sections

A. Section - Earthmoving

1.3 Reference Documents

A. American Society for Testing and Materials (ASTM)

1. ASTM C-1372 Specification for Segmental Retaining Wall Units
2. ASTM D-422 Particle Size Analysis
3. ASTM D-698 Laboratory Compaction Characteristics of Soil -Standard Effort
4. ASTM D-4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils
5. ASTM D-4595 Tensile Properties of Geotextiles - Wide Width Strip
6. ASTM D-5262 Unconfined Tension Creep Behavior of Geosynthetics
7. ASTM D-3034 Polyvinyl Chloride Pipe (PVC)
8. ASTM D-1248 Corrugated Plastic Pipe

B. Geosynthetic Research Institute (GRI)

1. GRI-GG4 Determination of Long Tern Design Strength of Geogrids
2. GRI-GG5 Determination of Geogrid (soil) Pullout

C. National Concrete Masonry Association (NCMA)

1. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW
2. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW

1.4 Submittals/Certification

A. Contractor shall submit a Manufacturer's certification, prior to start of work, that the retaining wall system components meet the requirements of this specification and the structure design.

B. Contractor shall submit construction drawings and design calculations for the retaining wall system prepared and stamped by a Professional Engineer registered in the state of South Carolina for any retaining walls greater than 3.5' in height. The engineering designs, techniques, and material evaluations shall be in accordance with the Manufacturer's Design Manual, NCMA Design Guidelines For Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable to designer).

1.5 Quality Assurance

A. Contractor shall provide evidence that the design engineer has a minimum of five years of documentable experience in the design for reinforced soil structures. The design engineer shall provide proof of current professional liability insurance with an aggregate coverage limit of not less than $2,000,000.

B. Owner shall provide soil testing and quality assurance inspection during earthwork and wall construction operations. Contractor shall provide any quality control testing or inspection not provided by the Owner. Owner's quality assurance program does not relieve the contractor of responsibility for quality control and wall performance.

1.6 Delivery, Storage and Handling

A. Contractor shall check all materials upon delivery to assure that the proper type, grade, color, and certification has been received.

B. Contractor shall protect all materials from damage due to jobsite conditions and in accordance with manufacturer's recommendations. Damaged materials shall not be incorporated into the work.

PART 2: PRODUCTS

2.1 Definitions

A. Modular Unit - a concrete retaining wall element machine made from portland cement, water, and aggregates.

B. Structural Geogrid - a structural element formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.

C. Unit Drainage Fill - drainage aggregate which is placed within and immediately behind the modular concrete units.

D. Reinforced Backfill - compacted soil which is placed within the reinforced soil volume as outlined on the plans.

2.2 Modular Concrete Retaining Wall Units

A. Modular concrete units shall conform to the following architectural requirements:

face color - standard manufacturers' color to be selected by the Owner and Architect.

face finish - sculptured rock face in angular tri-planer configuration. Other face finishes will not be allowed without written approval of Owner.

bond configuration - running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.

exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused lighting.

B. Modular concrete materials shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units.

C. Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with appropriate references:

compressive strength = 3000 psi minimum;

absorption = 8 % maximum (6% in northern states) for standard weight aggregates;

dimensional tolerances = ± 1/8" from nominal unit dimensions not including rough split face, ±1/16" unit height - top and bottom planes;

unit size - 8" (H) x 18" (W) x 12" (D) minimum;

unit weight - 100 lbs/unit minimum for standard weight aggregates;

inter-unit shear strength - 1500 plf minimum at 2 psi normal pressure;

geogrid/unit peak connection strength -1000 plf minimum at 2 psi normal force.

D. Modular concrete units shall conform to the following constructability requirements:

vertical setback = 1/8”± per course (near vertical) or 1”+ per course per the design;
alignment and grid positioning mechanism - fiberglass pins, two per unit minimum;
maximum horizontal gap between erected units shall be - 1/2 inch.

2.3 Shear Connectors

A. Shear connectors shall be 1/2 inch diameter thermoset isopthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units or approved equal based on manufacturer recommendations. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10 degrees F to + 100 degrees F.

B. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.4 Base Leveling Pad Material

A. Material shall consist of a compacted crushed stone base or non-reinforced concrete as shown on the construction drawings.

2.5 Unit Drainage Fill

A. Unit drainage fill shall consist of clean 1" minus crushed stone or crushed gravel meeting the following gradation tested in accordance with ASTM D-422:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75-100
No. 4	0 - 10
No. 50	0 - 5

B. One cubic foot, minimum, of drainage fill shall be used for each square foot of wall face. Drainage fill shall be placed within cores of, between, and behind units to meet this requirement.

2.6 Reinforced Backfill

A. Reinforced backfill shall be free of debris and meet the following gradation tested in accordance with ASTM D-422:

Sieve Size	Percent Passing
2 inch	100-75
3/4 inch	100-75
No. 40	0-60
No. 200	0-35

Plasticity Index (PI) <15 and Liquid Limit <40 per ASTM D-4318.

B. The maximum aggregate size shall be limited to 3/4 inch unless field tests have been performed to evaluate potential strength reductions to the geogrid design due to damage during construction.

C. Material can be site excavated soils where the above requirements can be met. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the backfill or in the reinforced soil mass.

D. Contractor shall submit reinforced fill sample and laboratory test results to the Architect/Engineer for approval prior to the use of any proposed reinforced fill material.

2.7 Geogrid Soil Reinforcement

A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.

B. Ta, Long Term Allowable Tensile Design Load, of the geogrid material shall be determined as follows:

Ta = Tult / (RFcr*RFd*RFid*FS)
Ta shall be evaluated based on a 75 year design life.

1. Tult, Short Term Ultimate Tensile Strength
   Tult is based on the minimum average roll values (MARV)

2. RFcr, Reduction Factor for Long Term Tension Creep
   RFcr shall be determined from 10,000 hour creep testing performed in accordance with ASTM D5262. Reduction value = 1.60 minimum.

3. RFd, Reduction Factor for Durability
   RFd shall be determined from polymer specific durability testing covering the range of expected soil environments. RFd = 1.10 minimum.

4. RFid, Reduction Factor for Installation Damage
   RFid shall be determined from product specific construction damage testing performed in accordance with GRI-GG4. Test results shall be provided for each product to be used with project specific or more severe soil type. RFid = 1.10 minimum.

5. FS, Overall Design Factor of Safety
   FS shall be 1.5 unless otherwise noted for the maximum allowable working stress calculation.

C. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the “Hinge Height” divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with NCMA SRWU-1 Test Method for Determining Connection Strength of SRW.

D. Soil Interaction Coefficient, Ci
Ci values shall be determined per GRI:GG5 at a maximum 0.75 inch displacement.

E. Manufacturing Quality Control
The geogrid manufacturer shall have a manufacturing quality control program that includes QC testing by an independent laboratory.
The QC testing shall include:
Tensile Strength Testing
Melt Flow Index (HDPE)
Molecular Weight (Polyester)

2.8 Drainage Pipe

A. If required, the drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with ASTM D-1248.

PART 3 EXECUTION

3.1 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proof roll foundation area as directed to determine if remedial work is required.

B. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner.

3.2 Base Leveling Pad

A. Leveling pad material shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6 inches and extend laterally a minimum of 6" in front and behind the modular wall unit.

B. Soil leveling pad materials shall be compacted to a minimum of 95 % Standard Proctor density per ASTM D-698

C. Leveling pad shall be prepared to insure full contact to the base surface of the concrete units.

3.3 Modular Unit Installation

A. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated.

B. Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.

C. Install shear/connecting devices per manufacturer's recommendations.

D. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.

E. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

3.4 Structural Geogrid Installation

A. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.

B. Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer.

C. The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid.

D. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

3.5 Reinforced Backfill Placement

A. Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage.

B. Reinforced backfill shall be placed and compacted in lifts not to exceed 6 inches where hand compaction is used, or 8 - 10 inches where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.

C. Reinforced backfill shall be compacted to 95% of the maximum density as determined by ASTM D698. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be dry of optimum, + 0%, - 3%.

D. Only lightweight hand-operated equipment shall be allowed within 3 feet from the tail of the modular concrete unit.

E. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

F. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.

G. At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

3.6 Cap Installation

A. Cap units shall be glued to underlying units with an all-weather adhesive recommended by the manufacturer.

3.7 As-built Construction Tolerances

A. Vertical alignment : ± 1.5" over any 10' distance.

B. Wall Batter: within 2 degrees of design batter.

C. Horizontal alignment: ± 1.5" over any 10' distance.
Corners, bends, curves ± 1 ft to theoretical location.

D. Maximum horizontal gap between erected units shall be 1/2 inch.

3.8 Field Quality Control

A. Quality Assurance - The Owner shall/may engage inspection and testing services, including independent laboratories, to provide quality assurance and testing services during construction. This does not relieve the Contractor from securing the necessary construction quality control testing.

B. Quality assurance should include foundation soil inspection. Verification of geotechnical design parameters, and verification that the contractor's quality control testing is adequate as a minimum. Quality assurance shall also include observation of construction for general compliance with design drawings and project specifications. Quality assurance is best performed by the site geotechnical engineer.

C. Quality control testing shall include soil and backfill testing to verify soil types and compaction and verification that the retaining wall is being constructed in accordance with the design plans and project specifications.

END OF SECTION 32 32 23

SECTION 328400-

UNDERGROUND IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. The work covered by this Section consists of furnishing all labor, equipment and materials and performing all operations necessary for installing an automatic irrigation system as shown on the Drawing and/or described by these Specifications. The work includes: preparation and excavation of trenches, installation of irrigation system (including: plastic pipe, fittings and connectors, sprinkler heads, automatic control valves and valve boxes, drip accessories, electric control cable, wiring to controller and required submittals).

1.02 QUALITY ASSURANCE:

A. Subcontract work to a single firm specializing in irrigation systems.

B. Manufacturer Qualifications. Provide underground sprinkler system as a complete unit produced by a single acceptable manufacturer including heads, valves, piping circuits, controls and accessories.

1.03 SUBMITTALS

A. Product Data: Submit three (3) copies (neatly stapled into sets) of manufacturer's catalog cuts, equipment data sheets, or shop drawings for the following products:
   1. Sprinkler heads
   2. Swing Joints
   3. Valves: electric and manual
   4. Controller and controller accessories
   5. Valve boxes
   6. Pipe and pipe fittings
   7. Control wire and splice connectors
   8. Drip components
   9. Solvent, primer and Teflon tape

B. Submit a written proposal including a breakdown of components to be used in the system and a complete description of the scope of work. Include all information of plumbing and/or electrical permits and fees. Also include with the written proposal:

   1. A letter(s) from the manufacturer(s) of all major components of the system (sprinklers, electric valves, controllers, and drip components) that a local authorized service center exists. The name and address of that service center shall be included in the letter. The same letter(s) shall also include the name of the local authorized manufacturer's representative.

PART 2 - PRODUCTS

2.01 SPRINKLER SYSTEM:

A. Manufacturer. Irrigation system products shall be by the following manufacturers:

- Rainbird Sprinkler Mfg. Corp. 1-800-247-3782 www.rainbird.com
- Walla Walla Sprinkler Co. 1-509-525-7907 www.mprotator.com
- The Toro Company 1-800-664-4740 www.toro.com

2.02 GRAVEL:

A. Material for gravel sump shall be pea gravel or approved equal.

2.03 PLASTIC PIPE AND FITTINGS:

A. The plastic pipe shall be rigid unplasticized PVC class 200 or class 160 (SDR 26), unless otherwise noted on drawings, extruded from virgin parent material. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles and dents. All plastic pipe shall be manufactured by CertainTeed, Johns-Mansville or approved equal.

B. All plastic pipe fittings shall be schedule 40 PVC and shall be manufactured by the same manufacturer as the plastic pipe.

2.04 SHRUB AND LAWN SPRINKLER HEADS:

A. All full and part circle sprinklers shall be of the fixed spray variety as is specified on the Drawing. These sprinklers shall be of the pop-up type with spring retraction. The body of the sprinkler shall be constructed of Cycolac Material and the sprinkler shall be easily serviced from the Manufacturer's specifications with regard to the diameter of throw and gallonage at a given pressure. Spacing of heads shall not exceed the manufacturer's maximum recommendation.

B. Matched precipitation will be required on all full and part circle sprinklers operation on the same zone.

2.05 PVC SLEEVING:

A. Schedule 40 PVC pipe shall be as noted on the drawings. These sleeves are to be used for proposed irrigation lines. Irrigation sub-contractor shall coordinate installation with General Contractor.

2.06 AUTOMATIC CONTROL VALVES:

A. The remote control valve shall be a normally closed 24 volt A.C. 50/60 cycle solenoid type. Valve pressure rating shall not be less than 150 PSI.

B. The valve body and bonnet shall be constructed of heavy duty glass-filled nylon, diaphragm shall be on nylon reinforced nitrile rubber. Solenoid coil shall be encapsulated in molded epoxy.

C. The valve body shall be activated by a low power, 2.0 watt 24 volt A.C. solenoid. The solenoid plunger shall have a filter to insure positive valve operation.

D. The valve shall have a flow control stem with wheel handle for regulation or shutting off the flow of water and a bleed screw for manual operation without electrically energizing the solenoid coil.

E. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

2.07 VALVE BOXES:

A. All control valves shall be installed in a valve box in accordance with manufacturer's specifications.

2.08 CONTROL VALVE CABLE:

A. All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be Type "UF", 14-1 stranded or solid copper, single conduction wire with PVC insulation and bear UL approval for direct underground burial feeder cable. Wire connections to remote control electric valves and splices of wire in the field shall use Pen-Tite wire connectors or approved equal and scaling cement.

2.09 BACKFLOW PREVENTER:

A. Install size as indicated on drawings and as per local codes.

2.10 DRIP IRRIGATION ACCESSORIES:

A. Filter. Provide filter at valve to each drip zone. Provide screen having equivalent of 140-mesh filtration capacity.

B. Pressure Regulator. Incorporate regulator into each drip system if supply pressure exceeds 40 PSI.

C. Closure Caps. Provide in accordance with manufacturer's recommendations.

2.11 AUTOMATIC RAIN SENSOR

A. The rain sensor shall be a micro electronic solid-state type, capable of interrupting the power from the irrigation controller to the valves when rainfall exceeds a preselected setting of 1/8” to 3/4”. Device shall be made of corrosion resistant plastic casing.

2.12 AUTOMATIC CONTROLLER:

A. The controller shall be capable of operating 24 V.A.C. electric remote control valves. The controller shall have an active day light with timing accurate to 1 minute per month. (See plan for more specific information).

B. The wall mount type controller cabinet shall be of injection molded high impact plastic which shall resist corrosion and provide for an attractive appearance. The door shall be mated with the other cabinet parts and be made of the same material. The controller shall be wall mounted as shown on the irrigation plan. The controller shall have adequate lightning protection.

PART 3 - EXECUTION

3.01 LAYOUT OF LINES:

A. The water lines will be laid at the locations shown on the plans. The Landscape Contractor shall stake out the location of each run of pipe and all sprinkler heads or valve locations for approval by Landscape Architect prior to digging trench.

B. The lawn irrigation system shall be installed so that it will drain at all points.

C. Install PVC pipe in dry weather when temperature is above 40° F in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperature above 40° F (4° C) before testing unless otherwise recommended by manufacturer.

3.02 EXCAVATION AND BACKFILL:

A. Trenches for PVC pipe main lines shall be excavated to sufficient depth of 12" minimum and an unspecified width to permit proper handling and installation of pipe and fittings. Trenches for PVC pipe lateral sprinkler lines shall be excavated to sufficient depth of 12" minimum and an unspecified width to permit proper handling and installation of pipe and fittings.

B. On sodded areas the Landscape Contractor will remove and replace the sod where possible from the trench area to the necessary width and depth required to facilitate his installation.

C. The backfill shall be thoroughly compacted and brought to finish grade, with proper allowance for topsoil. Selected dirt or sand shall be used if soil conditions are rocky. In rocky areas the trenching depth shall be two inches (2”) below normal trench depth to allow for this bedding. The pea gravel fill shall be usedin filling the top 4" above the pipe. The remainder of the backfill shall contain no lumps or rocks larger than three inches (3"). The top six inches (6") of backfill shall be free of rocks over one inch (1") diameter, subsoil or trash.

3.03 PLASTIC PIPE AND FITTINGS:

A. All pipe fittings and valves, etc. shall be installed and joined in accordance with the manufacturer'srecommendations. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipe shall be closed by approved means.

B. Pipe shall be firmly supported throughout its entire length. Extreme care shall be exercised to prevent low points except at drains so that every section of pipe is placed with positive gravity drainage flow towards a drain valve.

C. Sharp changes in alignment and grade shall be made with appropriate fittings. All elbows, tees and fittings shall be installed with a reaction block bearing against undisturbed soil to prevent breakage or separation of the joint.

3.04 AUTOMATIC CONTROL VALVES:

A. Automatic control valves shall be installed in accordance with the manufacturer's specifications.

3.05 VALVE BOXES:

A. Valve boxes shall be installed on a suitable base of gravel for proper foundation box and easy leveling of box to proper grade and also to provide proper drainage of the box. All valve boxes shall be provided with the proper size extensions, wherever required, to bring the valve boxes level with the finished grade.

3.06 ELECTRICAL INSTALLATION:

A. The Contractor will be required to make connections to the building electrical system as is required for the proper operation of the automatic control system. The entire installation shall fully comply with all local and state laws and ordinances and with all the established codes applicable thereto.

B. All control circuitry, whether electrical or hydraulic, passing through the wall of the building or beneath a sidewalk, road or drive shall be installed in a suitable sleeve; whereas in all other locations they shall be installed in the pipe trench and protected by the pipe whenever possible.

C. The joining of all underground wires shall be by the use of wire nuts covered with Scotch Lok per installation instructions provided by manufacturer.

3.07 CONTROL VALVE CABLE:

A. All control valve cables shall be installed by direct burial at a minimum depth of 12". Where practical the wire shall be installed in same trench as mainline pipe.

B. Extreme care shall be exercised during backfilling of trench to avoid damage and displacement of mainline pipe.

C. Control valve cable shall be fed through conduit from inside the building.

D. Each control valve shall be connected to one station of the controller by a control wire. All of the valves shall be connected to a common ground.

3.08 SPRINKLER HEADS:

A. Sprinkler heads shall be installed as shown on the drawings and in accordance with manufacturer's specifications. The height of each sprinkler head in relation to the finish grade shall be approved by the Landscape Architect.

3.09 INSTALLATION OF DRIP IRRIGATION SYSTEM:

A. Install main lines and valves. Before installing emitter laterals, perform pressure test then flush out sand, plastic shaving and other foreign matter.

B. Emitter Hose. Bury emitter laterals under 3 inches of mulch. Solvent weld each connection in accordance with manufacturer's recommendation to standard weight Schedule 40 PVC fittings and bushings. Install hose in a serpentine manner. When cutting hose, use a shearing tool such as a pipe cutter, knife or shears. Use only manufacturer's recommended tool and procedure when punching hose for emitters.

C. Emitter Heads. Connect emitter on a rigid PVC nipple to PVC drip lateral with a tee or elbow. Attach tubing to barbed fitting and daylight distribution tubing at rootball secured with stake. Add bug cap at end of secured distribution tubing. If necessary after installing emitters and before operating system, open end of drip lateral and flush lines clean. The number of emitters on a line shall not exceed manufacturer's recommendations for that hose or distribution tubing size and length.

3.10 BACKFLOW PREVENTERS: METERS

A. Install backflow preventer in new connection between connection and control valves, as per local codes.

B. Irrigation meter- Contractor shall pay for and install a separate irrigation meter to be utilized for this system. Location as shown on plan.

3.11 FLUSHING:

A. After all new sprinkler piping and risers are in place and connected for a given section, and all necessary work has been completed and prior to installation of sprinkler heads, all control valves shall be opened and a full head of water shall be flushed through the system to remove any foreign material.

3.12 TESTING:

A. Tests shall be made on portions of the line as completed. Final testing, however, shall be made on the entire system. Trenches shall be partially backfilled to prevent displacement of pipes.

B. Pressure test shall be performed to a maximum hydrostatic pressure of 200 PSI based on the elevation of the lowest point in the system and corrected to the elevation of the test gauge. Duration of the pressure test shall be at least one hour.

C. Leakage test shall be performed after satisfactory completion of the pressure test. The leakage test shall be conducted at a hydrostatic pressure of 130 PSI without showing a leakage in excess 7.5 gallons per hour. Extend the leakage test for a period of time necessary to allow inspection, but in no case shall the duration be less than two hours.

D. Remove and replace any defective materials of installations discovered in testing and repeat the test until satisfactory to the Landscape Architect. This work shall be performed at the Landscape Contractor's expense.

E. The tests shall be witnessed by the Landscape Architect.

3.13 AS-BUILT DRAWINGS:

A. After completion of the piping installation, the Landscape Contractor shall furnish a signed "as-built" drawing and a digital drawing in AutoCad 2007 or later showing exact dimensions, depths and locations of all pipe, drains, controls, heads, etc. of sprinkler system.

3.14 MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Provide four (4) hours of instruction for Owner's Representative's personnel upon completion of check/test/start-up/adjust operations. Owner's Representative shall be notified at least one (1) week in advance of check/test/start-up/adjust operations.

B. Upon completion of the irrigation system and in conjunction with application for final payment, submit <u>one</u> Maintenance and Operation Manual. Each Manual shall be a 3-ring binder with:
   1. One (1) hard copy and one digital drawing in AutoCad 2007 or later of the "RECORD" drawing of the irrigation system, and
   2. One (1) complete set of the "APPROVED" Submittals required in paragraph 1.06 above.
   3. One (1) copy of the suggested "SYSTEM OPERATING SCHEDULE" which shall call out the controller program required in order to provide 1.0" of water per week to each planted zone area and 1.5" of water per week to each turf zone area.
   4. A typewritten description of the procedures to be followed for proper winterization of the entire system.

C. Contractor shall be responsible for the first year's winterization and subsequent spring start-up procedures and shall perform these operations in the presence of the Owner's Representative's personnel.

3.15 CLEAN-UP:

A. Upon completion of the work and before acceptance and final payment will be made, the Landscape Contractor shall make any necessary repairs, adjustments and corrections to the work as required by the Drawings and Specifications. The Landscape Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures and all other items not incorporated into the work. The site shall be left in a neat and presentable condition. Any damage to roads buildings, walks, vegetation, utilities or any other item of personal property which is the responsibility of the Landscape Contractor, through accident, negligence or normal usage, shall be satisfactorily repaired or replaced as a requirement for completion of this contract.

3.16 GUARANTEE:

A. For a period of one year from date of final acceptance of the work performed under this Contract, the Landscape Contractor shall promptly furnish, without cost to the Owner, any and all parts and labor which prove defective in material, workmanship, or proper functioning of system.

END OF SECTION

SECTION 32 92 00
GRASSING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Grassing.

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

1. Division 31 Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.

2. Division 31 Section "Earthwork" for excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.

2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

E. Submit soil analysis results indicating recommended lime and fertilizer additive amounts.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

B. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.

C. The Contractor shall fully comply with all provisions of the Contract Documents including, but not limited to, providing and installing such entities as the products, materials, equipment, components, or systems that were proposed at the time bids were received. Except for extenuating circumstances as determined by the Architect, notification of not being able to meet any of the provisions of the Contract Documents or communicating conflicts in the Contract Documents to the Architect will not be considered after receipt of bids; and the Contractor shall fully comply with the Contract Documents at no increase in Contract Sum or Contract Time.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.6 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth,

except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.

1. Grass.

1.9 LAWN MAINTENANCE

A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days after date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches.

1. Water lawn at the minimum rate of 1 inch per week.

D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. of lawn area.

PART 2 - PRODUCTS

2.1 GRASS MATERIALS

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

1. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated on Schedules at the end of this Section.

2.2 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch or larger in any dimension, and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on the site if adequate for specified coverage of 2" over all disturbed areas. Supplement with import if required. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. If onsite topsoil is insufficient, contractor shall obtain, transport and spread suitable topsoil from other approved and acceptable sources at no additional cost at a minimum depth of 2". Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

2.3 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve.

B. Aluminum Sulfate: Commercial grade, unadulterated.

C. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

F. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

1. When site treated, mix with at least 0.15 lb of ammonium nitrate or 0.25 lb of ammonium sulfate per cu. ft. of loose sawdust or ground bark.

G. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

H. Herbicides: EPA registered and approved, of type recommended by manufacturer.

I. Water: Potable.

2.4 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.5 MULCHES

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Type: Pine straw.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, nontoxic and free of plant growth- or germination-inhibitors.

2.6 WEED-CONTROL BARRIERS

A. Sheet Polyethylene: Black, 0.006-inch minimum thickness.

B. Nonwoven Fabric: Polypropylene or polyester fabric, 3 oz. per sq. yd. minimum.

C. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz. per sq. yd.

2.7 EROSION-CONTROL MATERIALS

A. Flexterra HP FGM hydroseeded at a rate of 3500#/acre on all slope areas.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PLANTING SOIL PREPARATION

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

B. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

C. For planting lawns, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

   1. Mix lime with dry soil prior to mixing fertilizer. Prevent lime from contacting roots of acid-tolerant plants.

3.3 LAWN PLANTING PREPARATION

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous materials.

C. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.

1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.

D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:

1. Where grass cannot be reconditioned, remove and dispose of existing grass, vegetation, and turf damaged during construction activities. Do not turn over into soil being prepared for lawns.

2. Till surface soil to a depth of at least 6 inches. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.

3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.

E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches in any dimension, and other objects that may interfere with planting or maintenance operations.

F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.4 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.
B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

1. Thickness: 2 inches.

3.5 SEEDING NEW LAWNS

A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. Sow seed per the drawings.

C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes less than 1:6 against erosion by mechanically spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre to form a continuous blanket 1-1/2 inches loose depth over seeded areas. .

1. Anchor straw mulch by crimping into topsoil by suitable mechanical equipment.

3.6 HYDROSEEDING NEW LAWNS

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.

1. Mix slurry with Flexterra HP FGM at 3500#/acre.

3.7 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

3.10 SEED MIXTURES SCHEDULE

A. Full-Sun Mixture: Provide certified grass-seed blends or mixes per schedule indicated on site detail drawings.

3.11 SATISFACTORY LAWNS

A. Lawn installations shall meet the following criteria as determined by Engineer:

1. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 80 percent over any square yard.

END OF SECTION 32 92 00

SECTION 329300
LANDSCAPE WORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Work included: Work under this Section includes installation of all trees, shrubs, ground cover, annuals, sod and related work required for completion of the project as shown on the Drawings and specified herein.

1. Included hereunder are the furnishing of all equipment, materials and labor necessary to furnish and/or install soil treatment, sodding, planting and mulching of trees, shrubs and vines, protection, maintenance, guarantee and replacement of plants and all work related to the above as specified.

1.02 QUALITY ASSURANCE:

A. Contract landscape work to a single firm specializing in landscape work.

1.03 SOURCE QUALITY CONTROL:

A. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.

B. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Landscape Architect, together with proposal for use of equivalent material.

C. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil will be placed (spread) and rough graded by the General Contractor. Utilize any stockpiled topsoil, cleaned and screened, for re-use in Landscape Work. The contractor shall provide additional topsoil as required to complete Landscape Work. Landscape Contractor will be responsible for fine grading of areas to be planted and sodded. Areas to receive sod and/or plantings shall receive 4” minimum topsoil. Topsoil required shall be furnished as follows: Obtain topsoil only from naturally well-drained sites having similar soil characteristics to that found at Project Site and where topsoil occurs at a depth of not less than 4”. Do not obtain from bogs or marshes.

1. Topsoil shall not contain subsoil, debris, lumps or rocks larger than 1” in diameter, or weed seed.

2. Topsoil shall be classified as loam, silt loam, clay loam or any combination thereof. Classifications are as determined by the Bureau of Plant Industry, Soils and Agricultural Engineering USDA Triangular Soil Texture Chart.

3. Topsoil shall contain not less than 3 percent and not more than 10 percent, by weight of organic matter, as determined by weight loss upon ignition of oven-dried samples.

2.02 SOIL AMENDMENTS:

A. The Landscape Contractor shall furnish the Landscape Architect soil analysis and reports as performed by the Agricultural Extension Service or commercial testing laboratory for all area to receive planting. The Landscape Contractor shall incorporate necessary additives in proper quantities as recommended in the soil analysis, or as necessary to bring the soils up to acceptable standards. The Landscape Contractor shall include in his bid and shall pay for all tests required.

B. Commercial fertilizer shall be complete slow release fertilizer as specified by soil analysis and shall conform to the applicable state fertilizer laws. Fertilizer shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use will not be accepted.

C. Fertilizer Tablets or Packets. Fertilizer planting tablets or packets shall contain prolonged-release nitrogen, derived from Urea-formaldehyde. Tablets or packets shall be at least a strength of 16-8-5. The amount of available nitrogen, phosphorus or potash may be increased slightly to meet the standard manufactured products available. This fertilizer shall conform to the applicable state fertilizer laws and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis.

D. Herbicide shall be an approved commercial grade pre-emergent herbicide used in soil preparation. The particular type of herbicide shall be certified safe for the plants specified in the Plant List or for the plants around which the herbicide shall be used.

E. Lime shall be ground limestone (Dolomite) containing not less than eighty-five (85) percent of total carbonates and shall be ground to a fineness that fifty (50) percent will pass through a 100-mesh sieve and ninety (90) percent will pass through a 20-mesh sieve. Courser material shall be acceptable provided that specified rates of application are increased proportionally on the basis of quantities passing the 100-mesh sieve.

F. Compost shall be a domestic product consisting of partially decomposed vegetable matter of natural occurrence. It shall be brown, clean, and low in content of mineral and woody materials, mildly acid and granulated or shredded.

G. Ammonium nitrate shall be a commercially available agricultural chemical and shall be furnished under the manufacturer's guaranteed statement of analysis giving percentage of active ingredients.

H. Water. The Owner shall supply, at no expense, an adequate supply of water to meet the needs of this Contract. The contractor shall furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of planted areas as may be required to complete the work as specified.

2.03 STAKING:

A. Material for Staking and Guying:
   1. Material for staking and guying must be 2 1/2" x 2 1/2" x 8' long solid oak stake.
   2. Wire for fastening trees to stakes shall be No. 10 gauge pliable, galvanized iron. All wires to be placed with brightly colored uniform flagging for easy sighting.
   3. Hose to encase wire used for fastening trees to stakes shall be new or used two-ply reinforced rubber garden hose, black or green in color. Only one color shall be used throughout the project.

2.04 GRASSING

A. Sod shall be well-rooted, at least 98% Centipede completely free of noxious weeds and grasses. It shall be mowed to a height not to exceed 2" before lifting and shall be of uniform thickness, with not over 1-1/4" or less than 1" of soil and shall be approved by the Landscape Architect before planting.

B. Sprigs shall be healthy living stems (stolons or rhizomes) with attached roots, harvested without adhering soil and obtained from approved sources where sod is heavy and thickly matted. The presence of Johnson grass, Nutgrass or other objectionable grasses, weeds, or other detrimental materials will be cause for rejection. Not more than 24 hours shall elapse between harvesting and planting of sprigs, except that when weather or other uncontrollable conditions interrupt the work, a time extension may be granted, providing sprigs are still moist and viable. Sprigs that have heated in stockpiles, become frozen, allowed to become dry or otherwise seriously damaged will be rejected and shall be disposed of as directed by the Landscape Architect.

C. Grass seed shall be clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixtures composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified. Seed shall conform to all State laws and requirements and regulations of the SC Department of Agriculture. The Owner reserves the right to test, reject, or approve all seed.

2.05 MULCH:

A. Shredded and double hammered Hardwood Mulch shall be fresh, clean, and free from sticks and debris.

B. Samples of materials as listed below shall be submitted for inspection, on the site or as otherwise determined by the Landscape Architect. Upon approval of samples by the Landscape Architect, delivery of materials may begin.

MATERIALS	SAMPLE
Shredded and Double Hammered Hardwood Mulch	1 Gallon
Plants	1 of each
Sod	1 Roll

Typical samples shall be furnished from each separate source of supply. Approved samples shall be stored on the site and protected until furnishing of materials is complete. Plant samples may be planted in permanent positions, but labeled as samples.

2.06 PLANT MATERIALS (See Plant List):

A. Nomenclature. The names of plants required under this Contract conform to those given in Standardized Plant Names, 1942 Edition, prepared by the American Joint Committee on Horticultural Nomenclature. Names of varieties not included therein conform generally with names accepted in the nursery trade.

B. Quantities. Provide quantities necessary to complete the planting as shown on the drawings. Contractor must check quantities and differences shall be brought to the attention of the Landscape Architect.

C. Quality and Size. Plants shall have a habit of growth that is normal for the species and shall be sound, healthy, vigorous and free from insect pests, plant diseases and injuries. All plants shall equal or exceed the measurements specified in the Plant List which are minimum acceptable

sizes. They shall be measured before pruning with branches in normal position. Any necessary pruning shall be done at the time of planting. Requirements for the measurement, branching, grading, quality, balling and burlapping of plants in the Plant List generally follow or exceed the Code of Standards currently recommended by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock.

D. Substitutions will be permitted after Award of Contract only upon submission of proof in writing that a plant is not obtainable and authorization by the Landscape Architect for use of the nearest equivalent obtainable size or variety of plant having the same essential characteristics. Should this substitution result in the use of a smaller or less valuable plant, a change order will be issued with an equitable adjustment in contract price.

E. Type of Protection to Roots:
   1. Balled and Burlapped Plants. Plants shall be balled and burlapped unless otherwise noted on the Drawings. They shall be dug with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant and of minimum sizes shown on the Plant List. Balls shall be firmly wrapped with untreated burlap or similar material and bound with twine, cord or wire mesh. Where necessary to prevent breaking or cracking of the ball during the process of planting, the ball may be secured to a platform.
   2. Container-grown plants designated in the Plant List shall have been grown in a container such as pots, cans, tubs or boxes and have sufficient roots to hold earth together intact after removal without being root bound. Container size shall be in proportion to plant size and in accordance with AAN Standards. The Landscape Architect shall have the option to reject container-grown material if the growing media is too porous to hold adequate water for the plant's survival without watering more than once a week.

F. Protection after Delivery. The balls of plants which cannot be planted immediately upon delivery shall be covered with moist soil or mulch or provided with other protection from drying winds and sun. All plants shall be watered as necessary until planted.

PART 3 - EXECUTION

3.01 PLANTING METHODS:

A. Time of Planting. Planting operations shall be conducted under favorable weather conditions preferably during the period from October 1 to April 1. The Landscape Contractor has the option and assumes full responsibility for planting during unseasonable conditions. Trees should be dug and heeled in or in container and placed in a well watered holding area provided by the nursery or Landscape Contractor until the time of planting. Landscape Contractor to be responsible for the welfare of the tree until project is completed, when the owner will assume responsibility.

B. Plants to Remain. The Landscape Contractor shall take all necessary precautions to preserve and protect all existing plants that are to remain on the site. This shall include, but is not limited to, hand excavation of planting pits in close proximity to existing shrubs or within the spread of branches of larger trees, watering of existing materials adjacent to plant pits, trimming or pruning to permit installation of new plants or to repair damaged existing plants.

C. Obstructions Below Ground or Overhead:
   1. It is not contemplated that planting shall be done where the depth of soil over underground construction, obstructions or rock, is insufficient to accommodate the roots or where pockets in rock or impervious soil will require drainage. Where such conditions are encountered in excavation of planting areas and where the stone, boulders or other obstructions cannot be

broken and removed by hand methods in the course of digging plant pits of the usual size and where trees to be planted are found to be under overhead wires, other locations for the planting may be designated by the Landscape Architect.

2. Removal of rock or other underground obstruction, relocation of construction and provisions of drainage for planting areas shall be done only as directed by the Landscape Architect.
3. Should the Landscape Contractor encounter unsatisfactory surface or subsurface drainage conditions, soil depth, latent soils, hard pan, steam or other utility lines or any other conditions that will jeopardize the health and vigor of the plantings, he must advise the Landscape Architect in writing of the conditions prior to installing the plants. Otherwise, the Landscape Contractor warrants that the planting areas are suitable for proper growth and development of the plants to be installed.

D. Lawns
   1. See Planting Plans for location of areas to be sodded.
   2. Fine Grading Areas to be sodded shall be brought to within the thickness of the sod of the finished grade. Allowance for settlement shall be made. Fine grading for all areas will be performed by the Landscape Contractor prior to any planting or sodding.
   3. Soil Improvements:
      a. Ground limestone shall be applied at the rate recommended by the testing laboratory.
      b. Fertilizer shall be applied at the rate recommended by the testing laboratory.
      c. Application. Limestone shall be thoroughly mixed into the topsoil and as far ahead of sodding as possible, to prevent interfering with other grading operations.

E. Laying of Sod
   1. Before any sod is laid, all soft spots and inequalities in grade shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur, tamped or rolled and then watered thoroughly. The completed sodded surface shall be true to finished grade, even and firm at all points.
   2. Sod on slopes steeper than 2 1/2 to 1 shall be held in place by wooden pins about 1" square and about 6" long, driven through the sod into the soil until they are flush with the top of the sod or by other approved methods for holding the sod in place. Stakes shall be spaced along the center-line of a strip of sod at intervals of approximately 3'.
   3. During dry periods, sod must be watered as it is laid.

F. Sprigging
   1. Sprigs shall be applied at a rate no less than 17.5 bushels per 1,000 square feet (750 bushels per acre). Sprigging shall not be done during windy weather, or when the ground is excessively wet, frozen, or otherwise untillable. If the soil is not sufficiently moist when sprigs are being set, water shall be applied until the soil contains sufficient moisture. Sprigs shall be broadcast by hand or by suitable equipment in a uniform layer over the prepared surface with spacing between sprigs not to exceed 8 inches. The sprigs shall then be forced into the soil to a depth of 2 to 3 inches with a disk harrow or other satisfactory tool set to cover the sprigs to the required depth. A portion of the sprig foliage should be left exposed at the soil surface. After the planting of sprigs and prior to compaction, the surface shall be cleared of stone larger than 2-1/2”, large clods, roots, and other litter brought to the surface during sprigging. The sprigged areas shall be compacted within 24 hours from the time sprigging has been completed, weather and soil conditions permitting, by cultipackers, rollers, or other suitable equipment. Compaction shall not be done when the soil is in such condition that it is being picked up by the equipment, nor shall clay soils be compacted. Ensure adequate moisture to all sprigged areas during initial establishment period. A second application of fertilizer shall be applied after plants have become established, applied in a dry form as directed by soil testing results.

2. Acceptance. Sprigged areas shall achieve a 90% rate of coverage after 8 weeks, and 100% coverage at the end of the growing season. Coverage will be determined on a square yard basis.

G. Seeding
1. Areas to be seeded shall be uniform and shall conform to the finished grade as shown on the plans. The seedbed shall be loosened to a miniumum depth of 3 inches before agricultural lime, fertilizer or seed is applied. Areas to be seeded shall be cleared of stones larger than 2.5 inches in any dimension, roots and other debris. At areas to be grassed where the existing seed bed has little or no topsoil, the Contractor shall furnish and place topsoil in order to ensure a good stand of grass.
2. Lime and/or fertilizer shall be spread uniformly over the designated areas and shall be thoroughly mixed with the soil to a depth of 2 inches. Lime and fertilizer shall be applied at the rate specified by the soil test report. Lime and fertilizer may be applied by approved mechanical spreaders or by hydraulic methods as a mix of fertilizer and seed.
3. Within 24 hours following the covering of the seed, straw or hay mulch material shall be spread at the rate of 2 tons per acre. Mulch shall be held in place by an approved tacking agent applied at the manufacturer's recommended rate. Hydroseeding may be performed using 1500 pounds per acre wood, cellulose, or a wood/cellulose mix hydroseeding mulch with the manufacuturer's recommended rate of an approved tacking agent.
4. The Contractor shall obtain a satisfactory stand of perennial vegetation whose root system shall be developed sufficiently to survive dry periods and winter weather, and be capable of re-establishment in the spring. The perennial vegetative cover shall have a minimum coverage density of 70% for the seeded areas.

H. New Plantings:
1. Layout. New planting shall be located where shown on the Drawings except where obstructions below ground or overhead are encountered or where changes have been made in the construction. Necessary adjustments shall be made only after approval by the Landscape Architect. No planting, with the exception of ground cover, espalier plants and hedge, shall be placed closer than 2' to pavement or structures. The Landscape Contractor shall be responsible for staking and layout of plantings on this project. The Landscape Architect shall be advised when stakes are in place and ready for inspection on various planting areas. All layout work shall be inspected and approved by the Landscape Architect prior to opening any plant pits.
2. Planting Pits. Reasonable care shall be exercised to have pits dug and soil prepared prior to moving plants to their respective locations for planting to insure that they will not be unnecessarily exposed to drying elements or to physical damage. However, no open holes shall be left overnight or unmarked or unattended.
   a. Circular pits with vertical sides shall be excavated for all plants in beds or trenches. See Planting Plan for more detailed information regarding preparation of planting areas. Diameter of pits for trees and shrubs shall be at least 2'greater than the diameter of the ball or spread of roots. The depth of pits for trees, shrubs and vines shall be enough to accommodate the ball or roots when the plant is set to finished grade allowing for 6" of compacted topsoil or prepared soil in the bottom of the pit.
   b. Before planting any area, fill a representative sample of the excavated planting pits and beds with water to a depth 6" or more as required to verify if the subsoil is permeable enough to percolate satisfactorily and drain adequately after plants are installed. Advise the Landscape Architect in writing if any problems are anticipated regarding excessive ground water or unsuitable percolation.

I. Soil Preparation for Planting Trees and Shrubs:

1. Soil used in planting shall be existing soil and/or re-spread topsoil. The prepared soil mix in tree pits as herein before specified shall be thoroughly mixed with one part compost to three parts of existing soil.
2. Fertilizer tablets or packets shall be placed in each tree or shrub plant pit at a depth of 6" to 8" when the plant is set in place. The exact quantity and distribution of tablets or packets shall be in strict accordance with the manufacturer's recommendation for the sizes of material specified.
3. Excess excavated soil shall be disposed of off site by the Landscape Contractor unless specific permission is obtained from the owner to dispose of excess material on the site.

J. Soil Preparation for Planting Ground Cover and Annuals:
1. Loosen subgrade of lawn areas to a minimum depth of 6". Remove stones over 1 1/2" in any dimension, sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
2. Soil used in planting shall be existing soil as herein before specified and shall be thoroughly mixed with one part compost to three parts of existing soil.
3. Add specified soil amendments as per soil analysis and mix thoroughly into upper 4" of topsoil.
4. Excess excavated soil shall be disposed of off site by the Landscape Contractor unless specific permission is obtained from the Owner to dispose of excess material on the site.

K. Setting Plants. Unless otherwise specified, all plants shall be planted in pits, centered and set on 6" of compacted soil or prepared soil to such a depth that the finished grade level at the plant after settlement will be the same as that at which the plant was grown. Prior to setting container-grown plants, make four to five cuts 1/2" - 1" deep, top to bottom on root-bound mass to loosen roots. Plants shall be planted upright and faced to give the best appearance or relationship to adjacent structures. No burlap shall be pulled out from under balls. Plant forms, wires and surplus binding from top and sides of the balls shall be removed. All broken or frayed roots shall be cut off cleanly. Prepared soil shall be placed and compacted carefully to avoid injury to roots and to fill all voids. When the hole is nearly filled, add water as necessary and allow it to soak away. Fill the holes to finished grade. After the ground settles, additional soil shall be filled in, to the level of the finished grade.

L. Guying and Staking. Trees shall be supported immediately after planting. All trees shall be staked as detailed and shown on the Plans. Wires shall be encased in hose to prevent direct contact with the bark of the tree and shall be placed around the trunk in a single loop. Wires shall be tightened and kept taut by the use of turnbuckles. Stakes shall be equally spaced about each tree and shall be driven vertically into the ground to a depth of about 2' in such a manner as not to injure the ball or roots. Trees shall be fastened to each stake at a height where substantial branching will hold encased wire in place. Wire shall be doubled and twisted taut. Stakes shall be uniform in length and placed according to the type, size and location of the tree.

M. Herbicide Treatment. All tree saucers, shrub and ground cover beds shall be treated after plants have been installed with an approved pre-emergent herbicide recommended by the manufacturer. Plants installed during the fall planting season shall be treated with the approved herbicide during the first week of April of the following year. Plants installed in the spring shall be treated with the approved herbicide immediately after installation. Herbicide shall be cleared by the manufacturer as safe for use around plants itemized in the Plant List.

N. Shredded Hardwood Mulching. Tree and shrub beds shall be mulched with 3" of shredded hardwood mulch. This mulch shall cover the entire bed area and shall have a neat and well-defined edge between lawn area and shrub bed. Trees in lawn areas with individual saucers shall be mulched with 3" of shredded hardwood mulch.

O. Pruning and Repair. All pruning and repair work must be completed within a ten day period after planting. The amount of pruning included under the work of this Section shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots as a result of transplanting operations.
   1. Trees and some shrubs will be pruned back after planting to maintain a balance between the reduced root system and the branches. Care will be taken in this work to insure that the plants preserve their natural form.
   2. The natural form of newly planted trees and shrubs will be preserved in pruning by the removal of branches and/or part of branches at different lengths in accord with standard horticulture practices and as directed by the Landscape Architect. Pruning will always be done with a clean cut in living wood without bruising or tearing of bark and without leaving any stubs which would prevent the wound from healing over. Horizontal cuts may cause rot and will be avoided.

3.02 CLEAN-UP:

A. Clean-up. Any soil, bark, peat or similar material which has been brought onto paved areas within or outside the construction area by hauling operations or otherwise shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting, all excess soil, stones and debris which have not been cleaned up shall be removed from the site or disposed of as directed by the Landscape Architect. All planting areas shall be prepared for final inspection.

B. Other Work. The Landscape Contractor shall be responsible for the repair of any damage caused by his activities or those of his subcontractors within or outside the construction area such as the storage of topsoil or other materials, operation of equipment and other usage. Such repair operations shall include any regrading, sodding or other work necessary to restore damaged work or areas to an acceptable condition.

3.03 MAINTENANCE:

A. Maintenance shall begin immediately following the last operation of installation for each portion for each plant and shall continue until installation of planting is complete and the planting is formally accepted. Maintenance shall include mowing, watering, weeding, cultivating, mulching, tightening and repairing of guys, removal of dead material, resetting plants to proper grades or upright positions, restoration of the planting saucer and other necessary operations. Any damage resulting from planting operations shall be repaired promptly.

B. The Owner shall be responsible for all required maintenance after the planting is formally accepted (final acceptance).

C. Maintenance Instructions - Landscape Work. The Landscape Contractor shall submit to the Owner three (3) copies of typewritten instructions recommending the monthly procedures to be established by Owner for the maintenance of landscape work during the one-year guarantee period. Submit prior to the final inspection for acceptance.

3.04 INSPECTION FOR ACCEPTANCE:

A. Inspection of the work of this Section to determine completion of the Landscape Contractor's work, exclusive of the possible guarantee replacement of plants, shall be made by the Landscape Architect upon receipt of written notice requesting such inspection submitted by the Landscape Contractor at least ten (10) days prior to the anticipated date of inspection.

B. Acceptance. After inspection, the Landscape Contractor will be notified in writing by the Landscape Architect of acceptance of all work of this Section, exclusive of the possible replacement

of plants subject to guarantee or the Landscape Contractor will be notified in writing if there are any deficiencies from the requirements for completion of the work. Replacements, maintenance and repair work remaining to be done shall be subject to re-inspection before acceptance.

3.05 PLANT GUARANTEE AND REPLACEMENT:

A. Guarantee. This guarantee shall be provided to the owner by the contractor responsible for planting and irrigation. Plants shall be guaranteed for the duration of one (1) full year after the formal acceptance of the planting by the Owner and shall be alive and in satisfactory growth at the end of the guarantee period. The Owner shall be responsible for all maintenance necessary to keep the plants alive and healthy between the time the plantings are accepted and the end of the guarantee period. The basic needs of the plants during this period are for adequate water and protection from insects and other similar pests. Plants severely damaged by vandals are not subject to replacement by this Landscape Contractor.

B. Sodded lawn areas are not subject to a one year guarantee.

C. Should the Landscape Contractor find the plant material is not receiving the proper maintenance at any time prior to the end of the guarantee period, he should advise the Landscape Architect and the Owner immediately in writing so corrective measures may be initiated.

D. Replacement. At the end of the guarantee period, inspection will be made by the Owner and the Landscape Architect upon written notice requesting such inspection submitted by the Landscape Contractor at least ten (10) days prior to the anticipated date. Any plant installed under this Contract that is dead or not satisfactory in growth as determined by the Landscape Architect shall be removed from the site. These, and any plants missing due to the Landscape Contractor's negligence, shall be replaced as soon as conditions permit but during the normal planting season.
   1. Any plant that has die-back or otherwise loses 30% or more of its branches, excluding branches removed by trimming and pruning, as existing and living prior to removal from the nursery field shall be rejected. In case of any question, the Landscape Contractor may elect to allow such plant to remain through another complete growing season at which time the rejected plant, if found to be dead or in an unhealthy or badly impaired condition, shall be replaced.
   2. The Landscape Contractor shall be responsible for removing dead or diseased plants from the site during the guarantee period upon notification by the Owner or Landscape Architect. Dead plants may be removed by the Owner during the guarantee period provided they keep a photographic record of all plants removed. Photographs should show plant to such a degree that is clearly evident the plant is dead. Replacements shall be made only at the end of the guarantee period as described herein.
   3. The Landscape Architect shall inspect replaced plants when all replacements have been made. Any plant that is not alive and in a healthy vigorous condition shall be replaced again by the Landscape Contractor.

E. Materials and Operations. All replacements shall be plants of the same kind and size as specified in the Plant List. They shall be furnished and planted as specified under "New Planting", the cost of which shall be borne by the Landscape Contractor.

F. Replaced plants are not subject to a full one (1) year guarantee, but replacements must be alive and vigorous when inspected after planting and must leaf out fully in spring, if replacements are made while the plant is dormant.

END OF SECTION

SECTION 33 11 00

WATER DISTRIBUTION

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 water-distribution piping and specialties outside the building for the following:
   1. Fire-service mains.
   2. Water services.

1.3 DEFINITIONS

A. Fire-Service Main: Exterior fire-suppression-water piping.

B. Water Service: Exterior domestic-water piping.

C. The following are industry abbreviations for materials:
   1. DIP: Ductile Iron Pipe.
   2. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

   1. Piping specialties.
   2. Valves and accessories.
   3. Fire hydrants.
   4. Fire department connections.
   5. Water meters and accessories.

B. Field Quality-Control Test Reports: From Contractor.

C. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section. Include the following:
   1. Valves.
   2. Backflow preventers assemblies

3. Fire hydrants.

D. Shop Drawings: For the following:

1. Precast concrete vaults, including frames and covers, ladders, and drains.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Regulatory Requirements:

1. Comply with requirements of City of Columbia supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 latest edition for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

I. The Contractor shall fully comply with all provisions of the Contract Documents including, but not limited to, providing and installing such entities as the products, materials, equipment, components, or systems that were proposed at the time bids were received. Except for extenuating circumstances as determined by the Architect, notification of not being able to meet any of the provisions of the Contract Documents or communicating conflicts in the Contract Documents to the Architect will not be considered after receipt of bids; and the Contractor shall fully comply with the Contract Documents at no increase in Contract Sum or Contract Time.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Do not proceed with utility interruptions without Owner's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, Pressure Class 350 for sizes 6 – 12 inch pipe with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated. Lining to be AWWA C104 cement lining, standard thickness.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile-iron standard pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Manufacturer**s**:

a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. Grinnell Corporation; Mueller Co.; Water Products Div.
d. McWane, Inc.; Clow Valve Co. Div.
e. McWane, Inc.; Kennedy Valve Div.

f.

2. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, ductile-iron body and bonnet; with ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Minimum Working Pressure: 200 psig (1380 kPa).
b. End Connections: Mechanical joint.
c. Interior Coating: Complying with AWWA C550.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

1. Available Manufacturer**s**:
   a. Grinnell Corporation; Mueller Co.; Water Products Div.
   b. McWane, Inc.; Clow Valve Co. Div.
   c. McWane, Inc.; Kennedy Valve Div.
   d. McWane, Inc.; M & H Valve Company Div.

2. Tapping Sleeve: ductile-iron or stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
3. Valve: AWWA, cast-iron, nonrising-stem, metal resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering

"WATER," bottom section with base of size to fit over valve, and approximately 5-inch- (125-mm-) diameter barrel.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FM-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 CHECK VALVES

A. AWWA Check Valves:

1. Manufacturer**s**:

a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. Grinnell Corporation; Mueller Co.; Water Products Div.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. Watts Industries, Inc.; Water Products Div.

2. Check Valves: AWWA C508, swing-check type with 175-psig (1207-kPa) working-pressure rating and resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

2.7 FIRE HYDRANTS

A. Fire Hydrants: AWWA C502, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 250-psig (1035-kPa) minimum working-pressure design.
1. Manufacturer**s**:

a. American AVK Co.; Valves & Fittings Div.
b. Grinnell Corporation; Mueller Co.; Water Products Div.
c. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
d. McWane, Inc.; Kennedy Valve Div.
e. McWane, Inc.; M & H Valve Company Div.

2. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
3. Operating and Cap Nuts: Pentagon, 1-1/2 inches (40 mm) point to flat.
4. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
5. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.8 BACKFLOW PREVENTERS

A. Manufacturers:

1. Ames Co., Inc.
2. Conbraco Industries, Inc.
3. Grinnell Corporation; Mueller Co.; Hersey Meters.
4. Watts Industries, Inc.; Water Products Div.

B. General: ASSE standard, backflow preventers.

1. Working Pressure: 150 psig (1035 kPa) minimum, unless otherwise indicated.

2. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

C. Double-Check-Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Maximum Pressure Loss: 5 psig (35 kPa) through middle 1/3 of flow range.

2.9 WATER-METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter with lettering "WATER METER" in cover; and slotted, open-bottom base section of length to fit over service piping.

2.10 FIRE DEPARTMENT CONNECTIONS

A. Manufacturer**s**:

1. AFAC, Inc.; Badger Fire Protection.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire End & Croker Corporation.
4. Firematic Sprinkler Devices, Inc.
5. Grinnell Corporation.
6. Guardian Fire Equipment, Inc.
7. Reliable Automatic Sprinkler Co., Inc.
8. Smith Industries, Inc.; Potter-Roemer Div.

B. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.

1. Connections: Two NPS 2-1/2 (DN 65) inlets and one [NPS 4 (DN 100)] [NPS 6 (DN 150)] outlet.
2. Inlet Alignment: Inline

3. Finish Including Sleeve: Rough chrome plated.
4. Escutcheon Plate Marking: STANDPIPE.

2.11 ALARM DEVICES

A. Description: UL 753, FM approved, of types and sizes to mate and match piping and equipment.

B. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

C. Do not use flanges, unions, or keyed couplings for underground piping.

D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground Water-Service Piping: Use the following piping materials for each size range:
Service pipe shall be flexible high density polyethylene PE-3408. 1" service tubing shall be iron pipe size (IPS – ID controlled) SIDR rated conforming to ASTM D2239. 2" service tubing shall be iron pipe size (IPS – OD Controlled) to ASTM D-3035-SDR rated. Both size pipes shall be designated for 200 PSI. **Well pipe shall not be used.** Service pipe shall bear the manufacturer's name, pipe size, ASTM specification, NSF approval, working pressure and production code; letters shall be at least 3/16-inch high and repeated on the pipe at 24" intervals. Pipe shall be coiled and suitably packaged for protection during shipment, handling, and storage. Packages shall be labeled with the manufacturer's name, NSF seal, pipe size, coil length and part number. Service pipe to 1" and 2" shall be blue in color or designated with a longitudinal blue strip.

F. Underground Fire-Service-Main Piping: Use the following:
1. NPS 4 to NPS 8: Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, high-pressure, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FM, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:

    a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, rising stem.
    b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
    c. Check Valves: AWWA C508 swing-check valves.

3.4 JOINT CONSTRUCTION

A. See Division 2 Section "Utility Materials" for basic piping joint construction.

B. Make pipe joints according to the following:
1. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap or connection of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

F. Bury piping with depth of cover over top at least 36 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 36 inches (910 mm) cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm) additional cover.

G. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

H. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.

I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

J. Anchor service-entry piping to building wall.

K. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

L. See Division 13 Sections for fire-suppression water piping inside the building.

M. Install water-supply piping with shutoff valve in water supply to each post hydrant. Use curb valve and service box.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

3.7 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

3.8 BACKFLOW-PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

E. Test Backflow preventor per SCDHEC requirements and provide test to Engineer.

3.9 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated.

B. Install ball drip valves at each check valve for fire department connection to mains.

C. Install protective pipe bollards on two sides of each freestanding fire department connection.

3.10 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at 200 psi working pressure for 2 hours in accordance with NFPA 24.

C. Prepare reports of testing activities.

3.12 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.

B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel.

3.10 TESTING AND STERILIZATION:

A. Sterilization: All pipe, fittings and valves shall be thoroughly cleaned before being placed in the line. Before any section of line is placed in service, it shall be thoroughly sterilized. The Contractor shall continue the sterilization until water in the line has been approved. After sterilization, the line shall be drained and thoroughly flushed. Sterilization by the Contractor shall produce a disinfection solution of 50 PPM available chlorine in the system and allow the solution to be retained for a period of at least 24 hours. At the end of this 24 hour period the treated water shall contain no less than 10 PPM chlorine throughout the length of the main. 3/4 inch outlets shall be provided as required to insure adequate sampling of water during sterilization tests. After flushing with potable water, 2 satisfactory samples for bacteriological analysis should be taken from a number of sampling sites depending upon the amount of new construction but must include all dead-end lines and be representative of the newly constructed water system.These samples should be taken at least 24 hours apart and tested at a laboratory approved by the SCDHEC. At each sample site, chlorine residual must be measured and reported. If the membrane filter method of coliform analysis is used, non-coliform growth must be reported. The laboratory results must be submitted with the Registered engineer's letter of certification. No water mains shall be placed in service until approval from SCDHEC is obtained.

B. Hydrostatic Tests: The Contractor will be required to test each section of line between valves at a pressure of 200 PSI. This pressure shall be maintained for not less than 2 hours or as much longer as the Engineer may require in order to detect any leakage or defective material. The test pump, pipe connections, pressure gauges and all other necessary equipment shall be furnished by the Contractor. All air shall be removed from the line prior to initiating the tests. Any makeup water required shall be carefully measured and the leakage shall not exceed the allowable amount determined by the following:

PVC:

$L = [ND(P)^{1/2}] /7,400$

Where L = allowable leakage (gal/hr)
N = number of joints in length of pipeline tested
D = nominal diameter of pipe (inches)
P = average test pressure which should be no less than that specified for the pressure test (psig)

Ductile Iron:

$L = [SD(P)^{1/2}] /133,200$

Where L = allowable leakage (gal/hr)
S = length of the pipeline tested (feet)
D = nominal diameter of pipe (inches)
P = average test pressure which should be no less than that specified for the pressure test (psig)

Any leaking or sweating joints shall be corrected. This specification is to be used for all types of pipe. These tests must be witnessed by the Engineer or Director of Public Works.

The pressure test must be specified to be conducted in accordance with NFPA 24, latest edition or in accordance with the authority having jurisdiction.

C. Two successive satisfactory bacteriological samples taken at least 24 hours apart shall be obtained and the results submitted with the Engineer's letter of certification. The samples shall be analyzed by a state approved private laboratory. The results shall include both coliform and non-coliform growth. Do not perform samples until record drawings have been supplied to Engineer.

D. The disinfection of all new mains shall be conducted in accordance with AWWA C651 (including Section 4.8).

3.11 RECORD DRAWINGS

1) Contractor to provide “Record Drawings” of all water mains and appurtenances that meet the following requirements:
   a) All structures including bends to be referenced by field survey. Digital survey file to be provided to Engineer for preparation of Water Record Drawings to City of Columbia.
   b) Survey Drawing to be certified by a Registered Land Surveyor.
   c) Drawing to be provided for ample time for Engineer, City of Columbia and SCDHEC to conduct Final inspections for Permits to Operate. Survey file needed approximately 2 months prior to needing permanent water service.

END OF SECTION 33 11 00

SECTION 33 11 01

WATER DISTRIBUTION (FIRE)

1.1 GENERAL

1) Pipe work shall be installed at the locations shown on the plans and to the position, alignment and grade shown thereon, or in the event of grade conflict, as directed by the Engineer.

2) All pipe, special castings and fittings for water distribution shall be furnished in weights, classes, and/or thicknesses in accordance with specifications as outlined herein.

3) All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor.

4) Cast iron, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped.

5) In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

6) Pipe shall be handled so that the coating and lining will not be damaged. If, however, the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer

7) The water main shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations, spigots centered in bells; and all valve and hydrant stems plumb.

8) The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged.

9) All pipe shall be laid to the depth shown on the contract drawings. Any variation therefrom shall be made only at the order of the Engineer.

10) Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least six inches below and on each side of all pipe, valves, and fittings for pipes 24 inches in diameter or less, and nine inches for pipes larger than 24 inches in diameter. The specified minimum clearances are the minimum clear distances that will be permitted between any part of the pipe and appurtenances being laid and any part, projection, or point of such rock, boulder or stone.

11) The trench shall be dug so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of pipelaying as

specified or permitted by the Engineer. The trench shall be so braced and drained that the workmen may work in it safely and efficiently. It is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains, or storm sewers.

12) The width of the trench shall be ample to permit the pipe to be laid and joined properly, and the backfill to be placed and compacted as specified. trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting and bracing, and handling of specials.

13) Lubricants which will support microbiological growth shall not be used for slip-on joints. Vegetable shortening shall not be used to lubricate joints.

14) All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61.

15) Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water.

16) Where PVC, polyethylene, or any other non-metallic pipe is used in water main construction, a continuous #12 gauge blue insulated copper tracer wire, approved by the manufacturer for direct burial, shall be installed in the trench a minimum of 6" above the top of the water line. The tracer wire shall terminate at each valve or meter and tracking pipe and prevent interference of operating the valve or meter.

17) Contractor is responsible for coordinating payment with Owner of any tap fees associated with the construction of the water system. Contractor to provide all necessary drawings, "record drawing," notes, calculations required to insure that building(s) site and appurtenances are approved for use as designed. This information to be done by required professionals for certification to obtain operation permits necessary for occupancy.

1.2 SUBMITTALS

A. Product Data: For each type of water main appurtenance including fire hydrant, and gate valves.

1.3 QUALITY ASSURANCE

1) Regulatory Requirements:

Comply with requirements of the City of Columbia for supplying water. Include tapping of water mains and backflow prevention.

2) NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1.4 PROJECT CONDITIONS

1) Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated

a. Notify Construction Manager no fewer than three days in advance of proposed interruption of service.

b. Do not proceed with interruption of water-distribution service without Construction Manager's written permission.

2.1 CONSTRUCTION MATERIAL:

"Lead free" pipe, pipe fittings, solder and flux must be used in installation of all water mains. Pipe and pipe fittings containing no more than 8.0 percent lead are considered "lead free". Solder and flux containing no more than 0.2 percent lead are considered "lead free".

B. DUCTILE IRON PIPE: Ductile iron pipe will be designed in accordance with ANSI specification A 21.50 (AWWA C150) of latest revision for a normal working pressure of 150 PSI and Laying Condition "B". The pipe shall be manufactured in accordance with ANSI specifications 21.51 (AWWA C151) of latest revision. Joints shall be Bell and Spigot, Push-on (Glamorgan Tyton, American Fastite, Clow Bell-Tite or equivalent), or Mechanical; unless otherwise called for on the proposal form. Pipe will be cement-lined and seal-coated in accordance with ANSI specification A 21.4 (AWWA C104) of latest revision.

C. CAST IRON FITTINGS:

1) All cast iron fittings shall be in accordance with ANSI specification A21.10 (AWWA C110) of latest revision and ANSI specification A 21.11 (AWWA C111) of latest revision. The joints shall be Bell and Spigot, Push-on (Glamorgan Tyton, American Fastite, Clow Bell-Tite or equivalent), or Mechanical; unless otherwise called for on the proposal form. Compact ductile iron mechanical joint fittings, four inch through twelve inch size, shall be in accordance with ANSI specifications A21.53 (AWWA C153) of latest revision.

2) Fittings will be cement-lined and seal-coated in accordance with ANSI specification A21.4 (AWWA C104) of latest revision.

3) Gray cast iron fittings, 4 inch through 12 inch sizes, shall be Pressure Class 250 and 14 inch through 24 inch sizes shall be Pressure Class 150.

4) Ductile iron fittings, 4 inch through 12 inch sizes, shall be rated for 350 PSI working pressure and 14 inch through 24 inch sizes shall be rated for 150 PSI working pressure.

D. FIRE HYDRANTS:

1) All fire hydrants shall conform to the American Water Works Associations's Standard C502-85 and shall be guaranteed for one hundred fifty (150) pounds of working water pressure. Each hydrant shall have a 6 inch hub connection, one standard pumper nozzle and two nozzles for 2 1/2 inch diameter hose. Hose threads to be National Standard.

2) Hydrants shall be of the size commercially recognized as 5 inch hydrants with 5 1/4 inch valve opening. Hydrants shall include all materials necessary to bring the hydrant to its location above finished grade, including extensions.

3) Hydrants shall be open left..

1) Hydrants shall be Mueller Company "Centurion", American Valve and Hydrant Model "B-62-B quick Fix", U.S. Pipe and Foundary Model "H-205", Kennedy Valve Company "Guardian", or approved equal.

E. GATE VALVES: Gate Valves shall be of the double gate pattern with parallel seat, hub ends, iron body, bronze stemmed, designed for 150 PSI normal working pressure from both directions and conforming to the American Water Works Association Standard Specification C500-86 or subsequent revision. Valves 24 inches and larger shall be equipped with by-pass valves.

G. CONCRETE: This section includes all concrete work required, of every description, shown or specified, including pavements, bedding concrete, thrust blocks, etc. All materials incorporated in the concrete shall conform to the South Carolina Department of Highways and Public Transportation Standard Specifications for Highway Construction, latest edition.

I. REINFORCING STEEL: Reinforcing steel shall be of new billet steel intermediate grade made by the open hearth process, conforming to the requirements of the "Standard Specifications for Billet Steel Concrete Reinforcement Bars", Serial Designation C15-33 of the ASTM. Bars must be deformed in rolling, and the design of the deformation shall be in accordance with ASTM Designation A615-68. In addition to the reinforcing indicated on the plans, the Contractor shall furnish all necessary support bars, tie bars, etc., required for properly supporting and spacing the bars in the forms. The reinforcement will be subject to field inspection for rust, shape and dimensions.

J. PIPING INSTALLATION
   a. Water-Main Connection: Arrange with City of Columbia for tap of size and in location indicated on drawings. Tap must be made by City of Columbia approved contractor.
   b. Comply with NFPA 24 for fire-service-main piping materials and installation.
   c. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

3.1 TRENCHING:

1) All trenches and excavation shall be backfilled immediately after the pipes are laid therein, unless other protection of the pipe line is directed. The backfill material shall be selected and deposited with special attention to proper bedding

of the pipe. Except where special methods of bedding and tamping are provided for, clean earth, sand or rock dust shall be solidly tamped about the pipe. Minimum cover shall be 30 inches.

2) Trenching shall be in accordance with AWWA C-600-77, Sections "Clearing and Grubbing" and "Trenching". Maximum trench width shall be pipe diameter plus 2 feet. All excavated materials which are unsuitable for backfilling the trench shall be wasted in an area provided by the Contractor and Engineer.

3) The bottom of the trenches shall be graded in such a manner as to provide a firm bearing for the pipe. The use of boards of other materials to support the pipe will not be permitted. Any soft or unstable foundations encountered shall be removed and replaced with suitable material, thoroughly compacted, at the Contractor's expense. Bell holes shall be of sufficient size to allow proper construction.

4) The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. OSHA regulations shall govern.

5) To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards as required shall be placed and maintained during the progress of the construction work until it is safe for traffic to use the highway or street. All material piles, equipment, and pipe that may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. Safety rules and regulations of local authorities shall be observed.

6) All excavations shall be dewatered properly before laying pipe.

4.1 SEPARATION OF WATER MAINS AND SEWER:

1) Parallel Installation: Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, a deviation may be allowed on a case by case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

2) Crossings: Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the invert of the water main and the top of the sewer. Where a water line crosses under a sewer line, both the water and sewer line must be ductile iron. At crossing, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

3) Exception: SCDHEC must specifically approve any variance from the requirements of "Parallel Installations" and "Crossings" when it is impossible to obtain the specified separation distances.

4) Force Mains: There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossing as required in Part 1 and 2.

5) Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole.

5.1 BACKFILLING:

1) Backfilling shall be in accordance with Section 3.5 of AWWA C-600-77 or subsequent revisions thereof except as indicated below.

2) In backfilling trenches the material shall first be carefully placed around the pipe and thoroughly tamped up to the elevation of the top of the pipe in layers not exceeding 8 inches in thickness by means of power driven tampers; the remainder of the trench shall then be filled in layers not more than 8 inches in thickness and each layer thoroughly tamped. Where backfilling material is too wet for satisfactory tamping, the material shall be allowed to dry or dry material shall be hauled in. The Contractor will be held responsible for settlement over all trenches and, where necessary, he shall add material which shall be thoroughly tamped in the prescribed manner. Backfill should be compacted to 98% Standard Proctor unless otherwise noted.

3) Whenever the trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off and finally made to conform to the surface of the ground. Backfilling shall be carefully performed and the original surface restored to the full satisfaction of the Engineer.

6.1 CONNECTION TO THE EXISTING WATER MAIN

The Contractor will be required to connect the proposed mains with certain existing mains and connections as noted on plans but it will be incumbent upon the Contractor to ascertain the exact locations of these mains. All taps to be done with Mueller Tapping Valves and Sleeve.

7.1 EARTH CUSHIONS

Where water mains are laid over rock or under sanitary sewers, storm drains, gas lines, water mains, telephone ducts or other buried structures, the water mains shall be laid so as to provide a minimum 12 inch earth cushion between the proposed mains and the existing structures. In any case minimum separation required for sanitary sewers shall conform to SCDHEC regulations and these specifications.

8.1 PIPE LAYING

Pipe laying shall be in accordance with AWWA C-600-77, Section 3.3 and 3.4 or latest revision.

9.1 SETTING VALVES, FITTINGS AND HYDRANTS

Valves, fittings and hydrants shall be set in accordance with AWWA C-600-77 Sections 3.6 and 3.7 or latest revision. Appurtenances not covered therein shall be set in a manner approved by the Engineer.

10.1 CONCRETE THRUST BLOCKS:

1) Thrust blocking must be installed at all bends, ties, wyes, and hydrants to prevent movement in the line. The engineer will direct the Contractor as to the size, shape and extent of such concrete blocking.

2) Before placing metal reinforcement it shall be free from rust, scale or other coatings that will destroy or reduce the bond. Reinforcement shall be formed to the dimensions indicated on the plans. Cold bends shall be made around a pin having a diameter of four or more times the least dimensions of the bar. Metal reinforcement shall not be bent or straightened in a manner that will injure the material, Metal reinforcement shall be accurately placed and secured, and shall be design approved by the Engineer.

11.1 SAMPLING OUTLETS

3/4 inch outlets shall be provided as required to insure adequate sampling of water during sterilization tests.

11.2 TESTING AND STERILIZATION:

1) Sterilization: All pipe, fittings and valves shall be thoroughly cleaned before being placed in the line. Before any section of line is placed in service, it shall be thoroughly sterilized. The Contractor shall continue the sterilization until water in the line has been approved. After sterilization, the line shall be drained and thoroughly flushed. Sterilization by the Contractor shall produce a disinfection solution of 50 PPM available chlorine in the system and allow the solution to be retained for a period of at least 24 hours. At the end of this 24 hour period the treated water shall contain no less than 10 PPM chlorine throughout the length of the main. 3/4 inch outlets shall be provided as required to insure adequate sampling of water during sterilization tests. After flushing with potable water, 2 satisfactory samples for bacteriological analysis should be taken from a number of sampling sites depending upon the amount of new construction but must include all dead-end lines and be representative of the newly constructed water system.These samples should be taken at least 24 hours apart and tested at a laboratory approved by the SCDHEC. At each sample site, chlorine residual must be measured and reported. If the membrane filter method of coliform analysis is used, non-coliform growth must be reported. The laboratory results must be submitted with the Registered engineer's letter of certification. No water mains shall be placed in service until approval from SCDHEC is obtained.

2) Hydrostatic Tests: The Contractor will be required to test each section of line between valves at a pressure of 200 PSI. This pressure shall be maintained for not less than 2 hours or as much longer as the Engineer may require in order to detect any leakage or defective material. The test pump, pipe connections, pressure gauges and all other necessary equipment shall be furnished by the Contractor. All air shall be removed from the line prior to initiating the tests. Any

makeup water required shall be carefully measured and the leakage shall not exceed the allowable amount determined by the following:

PVC:

$L = [ND(P)^{1/2}] /7,400$

Where L = allowable leakage (gal/hr)
N = number of joints in length of pipeline tested
D = nominal diameter of pipe (inches)
P = average test pressure which should be no less than that specified for the pressure test (psig)

Ductile Iron:

$L = [SD(P)^{1/2}] /133,200$

Where L = allowable leakage (gal/hr)
S = length of the pipeline tested (feet)
D = nominal diameter of pipe (inches)
P = average test pressure which should be no less than that specified for the pressure test (psig)

Any leaking or sweating joints shall be corrected. This specification is to be used for all types of pipe. These tests must be witnessed by the Engineer or Director of Public Works.

3) The pressure test must be specified to be conducted in accordance with AWWA Standard C600-87, Section 4.

4) Two successive satisfactory bacteriological samples taken at least 24 hours apart shall be obtained and the results submitted with the Engineer's letter of certification. The samples shall be analyzed by a state approved private laboratory. The results shall include both coliform and non-coliform growth. Do not perform samples until record drawings have been supplied to Engineer.

5) The disinfection of all new mains shall be conducted in accordance with AWWA C651 (including Section 4.8).

12.1 RECORD DRAWINGS

1) Contractor to provide “Record Drawings” of all water mains and appurtenances that meet the following requirements:

a) All structures including bends to be referenced by field survey. Digital survey file to be provided to Engineer for preparation of Water Record Drawings to City of Columbia.
b) Survey Drawing to be certified by a Registered Land Surveyor.
c) Drawing to be provided for ample time for Engineer, City of Columbia and SCDHEC to conduct Final inspections for Permits to Operate. Survey file needed approximately 2 months prior to needing permanent water service.

END OF SECTION 33 11 01

SECTION 33 30 00

SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure and force-main, pressure sanitary sewerage outside the building, with the following components:
   1. Cleanouts.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water

B. Force-Main, Pressure-Piping Pressure Rating: At least equal to system operating pressure but not less than 150 psig

1.5 SUBMITTALS

A. Product Data: For the following:

   1. Pipe Coompliance

   2. Air release valves

B. Shop Drawings: For the following:

   1. Pump Station Basin and Pump controls, operations manual.

C. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.3 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Pipe and Fittings: SDR 26, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals. Pipe and fittings must meet ANSI/ASTM D3034-78 and shall be installed in accordance with ANSI/ASTM D 2321-74. Only Class I, II, and III embedment materials may be used in bedding, haunching, and initial backfill.

B. PVC Pressure Force Main: All PVC pipe less than 4” shall be Class 200, ASTM D2241.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.5 PRESSURE-TYPE PIPE COUPLINGS

A. PIPE JOINTS. Slip joints shall be manufactured in accordance with AWWA Specification C111.

B. Bell shall be shaped to receive the circular gasketed coupling. Spigot ends shall have tapered ends. Rubber gasketing shall conform to ASTM D1869, latest revision.

C. Connections shall be made by installing manufacturer's lubricant guiding tapered end into bell until contact with gasket, and applying steady force sufficient to make solid contact between tapered end and base of bell.

2.6 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

   1. Manufacturers:

      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.
      c. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

   2. Top-Loading Classification: Heavy duty.
   3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

   1. Manufacturers:

      a. Canplas Inc.
      b. IPS Corporation.
      c. NDS Inc.
      d. Plastic Oddities, Inc.
      e. Zurn Light Commercial Specialty Plumbing Products; Zurn Plumbing Products Group.

2.7 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

   1. Diameter: 48 inches minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
11. Protective Coating: Plant-applied, 10-mil minimum thickness applied to interior surfaces.
12. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- (100-mm-) minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

    a. Material: ASTM A 536, Grade 60-40-18 ductileiron, unless otherwise indicated.
    b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.8 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

    a. Invert Slope: 1percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

    a. Slope: 4 percent.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Gravity-Flow, Nonpressure Sewer Piping: Use the any of the following pipe materials for each size range:
   1. NPS 6: ductile-iron, gravity sewer pipe; ductile-iron standard fittings; gaskets; and gasketed joints.
   2. NPS 6: PVC SDR 26 pipe and fittings, gaskets, and gasketed joints.

B. Force-Main, Pressure Piping: Use the following pipe materials for each size range:

   1. NPS 2: PVC Schedule 40, water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

F. Install gravity-flow, nonpressure, drainage piping according to the following:
   1. Install ductile-iron, gravity sewer piping according to ASTM A 746.
   2. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

G. Install force-main, pressure piping according to the following:

   1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
   2. Install piping with 36-inch minimum cover.

3. Install PVC force main piping according to AWWA Standard C605, latest edition.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.4 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
3. Join dissimilar pipe materials with nonpressure-type, flexible[or rigid] couplings.

B. Join force-main, pressure piping according to the following:
1. Join PVC pressure piping according AWWA M23 for gasketed joints.

3.5 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

E. Install manhole cover inserts in frame and immediately below cover.

3.6 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.7 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use heavy-duty, top-loading classification cleanouts in all areas.

B. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."

B. Connect pressure, force-main piping to building's sanitary force mains specified in Division 22 Section "Sanitary Waste and Vent Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.
   1. Make branch connections from side into existing underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

      a. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

   2. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
   1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:

      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.

   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new gravity piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Contractor is required to Air Test completed piping systems in the presence of the Engineer and pull mandrel through 8 inch mains.
3. Schedule tests and inspections with Engineer and authorities having jurisdiction with at least 48 hours' advance notice.

    a. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

E. Contractor to flush all new sewer service lines and mains. Immediately after flushing, perform video inspection of all exterior sanitary service lines and mains. Provide digital copy of video to engineer for inspection prior to requesting final inspections.

F. Force Main Testing:
    1. TESTING. Where any section of the line is provided with concrete thrust blocking, the hydrostatic pressure test shall not be made until at least five days after the concrete is placed. Each completed section of the sewer line shall be plugged at both ends and slowly filled with water. As the line is being filled with water in preparation for the hydrostatic pressure test, all air shall be expelled from the pipe through the blowoffs or air relief valves. The pipe shall be subjected to hydrostatic pressure of 150 pounds per square inch for a period of two hours. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage shall not exceed 200 gallons per inch diameter per mile of pipeline per day. During the duration of the test, the lines shall be thoroughly examined for leakage at the joints and elimination of leakage effected where necessary. “Make up” water shall be measured with a displacement meter. Any cracked or defective pipes, fittings, or valves discovered in consequence of the pressure test shall be removed and replaced by the Contractor at his own expense. After replacing or correcting cracked or defective pipes, fittings, or valves discovered in consequence of the pressure test shall be removed and replaced by the Contractor at his own expense. After replacing or correcting cracked or defective pipes, fittings, or valves discovered in the test or correcting any leakage, the Contractor shall re-test the pipe. Construction of all sewer lines shall be such that they satisfy a leakage test in accordance with AWWA Standards for pipe installed.

        Where sewer line construction ties into existing lines, and where it is not practicable to make a hydrostatic test, the Contractor shall leave this section of sewer line uncovered for inspection for a period of 48 hours after the connection has been made and the line placed in service. Any leakage discovered in these sections shall be immediately corrected by the Contractor.

3.11 CLEANING

A. Clean interior of piping of dirt and superfluous material.

3.12 RECORD DRAWINGS

A. Contractor is responsible for providing surveyed elevations of all new manholes, including rim elevations, and pipe inverts. Survey is to be completed by a Registered Land

Surveyor in South Carolina. Provide a Digital and Hard Copy Plan to Engineer before requesting a final inspection.

END OF SECTION 33 30 00

SECTION 33 40 00

STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Refer to Civil Drawings for material types to be used.

1.2 SUMMARY

A. This Section includes sewerage and drainage systems outside the building. Systems include the following:

1. Storm drainage.

B. Related Sections: The following Sections contain requirements that relate to this Section.
1. Division 22 Section "Plumbing Piping" for building drains.
3. Division 22 Section "Drainage and Vent Systems" for building drains.
4. Division 33 Section "Foundation Drainage Systems" for foundation drain connecting to storm drainage system.

1.3 DEFINITIONS

A. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least 1.5 times the maximum test pressure.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product data for the following:

1. Shop drawings for precast concrete manholes and other structures. Include frames, covers, and grates.

1.6 QUALITY ASSURANCE

A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.

B. The Contractor shall fully comply with all provisions of the Contract Documents including, but not limited to, providing and installing such entities as the products, materials, equipment, components, or systems that were proposed at the time bids were received. Except for extenuating circumstances as determined by the Architect, notification of not being able to meet any of the provisions of the Contract Documents or communicating conflicts in the Contract Documents to the Architect will not be considered after receipt of bids; and the Contractor shall fully comply with the Contract Documents at no increase in Contract Sum or Contract Time.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures in direct sunlight.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, pipe fittings, and seals from dirt and damage.

D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.8 PROJECT CONDITIONS

A. Site Information: verify existing utility locations.

B. Locate existing structures and piping to be closed and abandoned prior to beginning any new drainage work.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

2. Do not proceed with utility interruptions without receiving Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. PVC Piping:

1. Pipe: ASTM D 1785, Schedule 40 PVC, with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 2466, Schedule 40 PVC, socket type.

B. Corrugated High Density Polyethylene Pipe (HDPE)

1. Pipe sizes 4" – 10" HDPE: **ADS N-12 ST IB** pipe (per ASTM F2648) shall have a smooth interior and corrugations.

   Pipe shall be joined using a bell & spigot joint meeting ASTM F2648. The joint shall be soil-tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.

   Fittings shall conform to ASTM F 2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of ASTM F 2306.

   Material for pipe production shall be an engineered compound of virgin and recycled high density polyethylene conforming with the minimum requirements of cell classification 424420C (ESCR Test Condition B) for 4- through 10-inch (100 to 250 mm) diameters, , as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%.

   Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot. (0.3 m) and for 60-inch (1500 mm) diameters, the minimum cover shall be 2 ft. (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1 (compacted), or Class 2 (minimum 90% SPD) material. Maximum fill heights depend on embedment material and compaction level and should be in accordance with manufacturer's recommendations.

2. **ADS N-12 HP**: Pipe sizes 12"-30" HDPE: 12- through 30-inch (300 to 750 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO MP-21-11. Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 and F2881, for the respective diameters. 12- through 60-inch (300 to 1500 mm) shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. 12- through 60-inch (300 to 1500 mm) diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.

   Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO MP-21-11, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

   To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field-testing any pipe material. Contact the manufacturer for recommended leakage rates.

   Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO MP-21-11, Section 6.1, for the respective diameters.

Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in traffic areas for 12- through 48-inch (300 to 1200 mm) diameters shall be one foot. (0.3 m) and for 60-inch (1500 mm) diameters, the minimum cover shall be 2 ft. (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1, Class 2 (minimum 90% SPD) or Class 3 (minimum 95%) material. Maximum fill heights depend on embedment material and compaction level; please refer to manufacturer's recommendations

2.2 MANHOLES AND CATCH BASINS

A. Standard Precast Concrete Manholes: Precast Structures shall be provided in accordance with SCDOT Standard Specification 719.2.9.
   a. Castings to be provided in accordance with SCDOT Spec. 719.2.5.

B. Built in Place concrete Brick Manholes: Built in place structures in accordance with SCDOT Standard Specification 719 and in accordance with SCDOT Standard Details shown on the plans.

C. Manhole Frames, Grates, and Covers:

1. Frames and Grates: Heavy-duty frames and grates according to SCDOT standards.
2. Storm Drainage Piping Systems: STORM SEWER.

D. Nyloplast Drain Basins

1. GENERAL: PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.
2. MATERIALS: The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454. The grates and frames furnished for all surface drainage inlets shall be ductile iron for sizes 8", 10", 12", 15", 18", 24" and 30" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas. 12" and 15" square grates will be hinged to the frame using pins. Metal used
   in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black.

3. INSTALLATION: The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.

2.3 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling of Storm Drainage Piping to be in accordance with SCDOT Standard Specification SC-M-714, for the respective type of pipe used with the following exceptions:

1. Backfill compaction testing will be in accordance with Geotechnical Report recommendations.
2. Video Inspection will be required on the storm installation. Video Inspection to be in accordance with SCDOT Spec SC-M-714.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install HDPE and PVC in accordance with manufacturer's specification.

3.3 PIPE JOINT CONSTRUCTION

1. Join gravity-flow, nonpressure drainage piping according to SCDOT Supplemental Technical Specification SC-M-714, latest edition.

3.4 MANHOLE AND CATCH BASIN INSTALLATION

A. General: Install manholes and Catch Basins in accordance with SCDOT Standard Specification Section 719, latest edition.

3.6 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the location and arrangement of underground sewerage and drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated. Notify Architect of any discrepancies found on the drawings or in the field.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

3.7 FIELD QUALITY CONTROL

A. Visually inspect 100% of pipe for fractures, cracks, spalling, chips, and breaks during all phases of the installation process. Inspect joints, including tongues and grooves. Inspect installed joints for missing, damaged, or improperly installed joint sealant or gasket. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:

   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of 9-Fin Mandrel.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials, and repeat inspections until defects are corrected.

B. Video Inspect Storm drainage after backfill in accordance with SCDOT SC-M-714 and as noted on the drawings. Provide digital copy of video inspection to Engineer.

C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 33 40 00