UNC Caldwell Hall Accessibility Upgrades
Project Manual

SCO ID: 22-25217-02A

UNC PROJECT ID: CIP21537

Construction Documents 02/28/2025

Architect, Prime:

REID architecture PLLC

Client:

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

SECTION 000107

SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

ARCHITECT
Company: REID architecture PLLC
Name: Joseph Reid Freeman
License Number: RA 12380
Responsible for Divisions 01-10, 14

STRUCTURAL ENGINEER
Company: LERA Consulting Structural Engineering RLLP
Name: Richard Garlock
License Number: PE 059185
Responsible for Divisions 03 - section 03300, and Division 05 – sections 05100 and 05300

MECHANICAL ENGINEER
Company: Sud Associates P.A.
Name: Dixie Davis
License Number: PE 14050
Responsible for Divisions 23

ELECTRICAL ENGINEER
Company: Burdette Engineering Inc.
Name: Donald Burdette
License Number: PE 12042
Responsible for Divisions 26, 27, and 28

PLUMBING ENGINEER
Company: Sud Associates P.A.
Name: Dixie Davis
License Number: PE 14050
Responsible for Divisions 22

CIVIL ENGINEER
Company: RVE Consulting Engineers
Name: Patrick Haramija
License Number: PE 053340
Responsible for Divisions 31, 32, and 33

END OF SECTION 000107

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SECTION 001010

ADVERTISEMENT FOR BIDS

Advertisement For Bids

Sealed proposals will be received until April 30th, 2024 at 2:00 pm in UNC Chapel Hill Giles F. Horney Building, 103 Airport Drive, Room 129, Chapel Hill, North Carolina and publicly opened and read for the furnishing of labor, material and equipment for the construction of:

University of North Carolina at Chapel Hill
Caldwell Hall Accessibility Upgrades
Chapel Hill, North Carolina
SCO ID No.: 22-25217-02A Code: 42123 Item: 360

Bids will be received for single prime bid contracts. All Proposals will be lump sum.

Complete plans and specifications for this project may be obtained for purchase at Sharpe Images Raleigh, 5605 Chapel Hill Road, Raleigh, NC 27607 (500) 688-0629. Electronic copies can be made available to Prime Bidders only beginning September 23, 2024 by contacting REID Architecture PLLC via e-mail office@reidarc.com (646) 477-1096.

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

The bidder must include completed minority business subcontractor documentation form(s) with their proposal or the bid may be considered non-responsive and invalid.

Pre-Bid Meeting

An open pre-bid meeting will be held for all interested bidders on April 8, 2025 at 10:00 am in Room 100A in the Giles F. Horney Building, 103 Airport Drive, Chapel Hill, North Carolina 27599 or virtually at https://unc.zoom.us/j/93783105051?from=addon (Meeting ID: 937 8310 5051). The meeting will address project specific questions, issues, bidding procedures and bid forms.

A copy of pertinent sections of the performance standards may be obtained by contacting the designer at the address or phone number noted above.

Chris Johnson
Assistant Director, Facilities Planning & Project Management

University of North Carolina at Chapel Hill
Division of Facilities Services
103 Airport Drive
Giles F. Horney Building Office 202J
CB #1090
Chapel Hill, NC 27599-1090

cljohns@email.unc.edu
(919) 843-0849

SECTION 002010

NOTICE TO BIDDERS

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

Sealed proposals will be received by the University of North Carolina until April 30, 2025 up to 2:00pm in Room 100A in the Giles F. Horney Building, 103 Airport Drive, Chapel Hill, North Carolina 27599 and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment for the construction of:

University of North Carolina at Chapel Hill
Caldwell Hall Accessibility Upgrades
Chapel Hill, North Carolina
SCO ID: 22-25217-02A Code: 42123 Item: 360

The primary scope of the project involves the addition to an existing academic building to provide accessible access and improved egress through an exterior stair and a new elevator.

Bids will be received for single prime bid contracts. All proposals shall be lump sum.

Pre-Bid Meeting

An open pre-bid meeting will be held for all interested bidders on April 8, 2025 at 10:00 am in Room 100A in the Giles F. Horney Building, 103 Airport Drive, Chapel Hill, North Carolina 27599 or virtually at https://unc.zoom.us/j/93783105051?from=addon (Meeting ID: 937 8310 5051). The meeting will address project specific questions, issues, bidding procedures and bid forms.

Complete plans, specifications and contract documents will be open for inspection in the offices of the University of North Carolina at Chapel Hill, Facilities Planning and Design and available via the plan rooms of ConstructConnect, Deltek and Dodge Construction Network as well as the Minority Plan Rooms at:

Hispanic Contractors Association of the Carolinas (HCAC) Raleigh, North Carolina. (877) 227-1680.

National Institute of Minority Economic Development (NIMED) Plan & Resource Center, 114 West Parrish Street, Durham, North Carolina 27701, (919) 956-8889.

or may be obtained for purchase at **Sharpe Images Raleigh**, 5605 Chapel Hill Road, Raleigh, North Carolina 27607, (800) 688-0629.

NOTE: The bidder shall include with the bid proposal the form *Identification of Minority Business Participation* identifying the minority business participation it will use on the project and shall include either *Affidavit **A*** or *Affidavit **B*** as applicable. Forms and instructions are included within the Proposal Form in the bid documents. Failure to complete these forms is grounds for rejection of the bid. (GS143-128.2c Effective 1/1/2002.)

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

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

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the bid bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

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

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

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 30 days.

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

Designer:	Owner:
REID architecture PLLC	University of North Carolina at Chapel Hill
(Name)	*(Agency/Institution)*
56 2nd Ave #4, Brooklyn, NY 11215	103 Airport Drive, Chapel Hill NC 27599
(Address)	*(Address)*
(646) 477-1096	(919) 843-0849
(Phone)	*(Phone)*

SECTION 003010

INSTRUCTION TO BIDDERS

INSTRUCTIONS TO BIDDERS

AND

GENERAL CONDITIONS OF THE CONTRACT

STANDARD FORM FOR CONSTRUCTION PROJECTS

UNIVERSITY OF NORTH CAROLINA

SYSTEM OFFICE

Sixth Edition – June 2021

INSTRUCTIONS TO BIDDERS

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

1. **PROPOSALS**

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

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

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

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

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

c. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.

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

e. All signatures shall be properly witnessed.

f. If the contractor's license of a bidder is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the proposal. The title "Licensee" shall appear under his/her signature.

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

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

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

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

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

2. **EXAMINATION OF CONDITIONS**

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

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

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

3. **BULLETINS AND ADDENDA**

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

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

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

4. **BID SECURITY**

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

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

5. **RECEIPT OF BIDS**

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

6. **OPENING OF BIDS**

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

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

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

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

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

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

f. If the unit prices contained in the bid schedule are unacceptable to the owner.

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

7. **BID EVALUATION**

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

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

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

b. A listing of completed projects of similar size.

c. Permanent name and address of place of business.

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

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

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

g. If prequalified, contractor information may be reviewed and evaluated comparatively to submitted prequalification package.

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

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

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

8. **PERFORMANCE BOND**

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

9. **PAYMENT BOND**

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

10. **PAYMENTS**

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

11. **PRE-BID CONFERENCE**

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

12. **SUBSTITUTIONS**

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

Submittals for proposed substitutions shall include the following information:

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

b. Trade name, model or catalog designation.

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

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

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

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

GENERAL CONDITIONS OF THE CONTRACT

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ARTICLE 1 - DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

x. **Commissioning** is a quality assurance process that verifies and documents that building components and systems operate in accordance with the project design documents.

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

z. **SCO Final Inspection** is the inspection performed by the State Construction Office to determine the completeness of the project in accordance with North Carolina Building Codes.

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

bb. **Final Acceptance** is the date on which the State Construction Office approves the project as complying with the North Carolina Building Codes and the owner accepts the construction as totally complete. This includes certification by the Designer that all punch list items are completed.

ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

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

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

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

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

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

3. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.

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

5. All signatures shall be properly witnessed.

6. If the contractor's license is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the contract. The title "Licensee" shall appear under his/her signature.

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

8. Each copy of the bonds shall be countersigned by an authorized individual agent of the bonding company licensed to do business in North Carolina. The title "Licensed Resident Agent" shall appear after the signature.

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

10. The contractor's signature on the performance bond and the payment bond shall correspond with that on the contract. The date of the performance and payment bond shall not be prior to the date of the contract.

ARTICLE 3 - CLARIFICATIONS AND DETAIL DRAWINGS

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

b. The contractor(s) and the designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject

to addition or change in accordance with progress of the work. The designer shall furnish drawings or clarifications in accordance with that schedule. The contractor shall not proceed with the work without such detail drawings and/or written clarifications.

ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS

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

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

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

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

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

ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA

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

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

c. The Designer shall review required submittals promptly, noting desired corrections if any, and retaining two (2) copies (one for the Designer, one for the owner) for his use. The remaining copies of each submittal shall be returned to the Contractor not later than twenty (20) days from the date of receipt by the Designer, for the Contractor's use or for corrections and resubmittal as noted by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittals.

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

ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE

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

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

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

ARTICLE 7 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS

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

ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES

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

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

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

d. Products are generally specified by ASTM or other reference standard and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally

acceptable, the Contractor has the option of using any product and manufacturer combination listed. However, the contractor shall be aware that the cited examples are used only to denote the quality standard of product desired and that they do not restrict bidders to a specific brand, make, manufacturer or specific name; that they are used only to set forth and convey to bidders the general style, type, character and quality of product desired; and that equivalent products will be acceptable. Request for substitution of materials, items or equipment shall be submitted to the designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Alternate materials may be requested after the award if it can clearly be demonstrated that it is an added benefit to the owner and the designer and owner approve.

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

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

ARTICLE 9 - ROYALTIES, LICENSES AND PATENTS

It is the intention of the contract documents that the work covered herein will not constitute in any way infringement of any patent whatsoever unless the fact of such patent is clearly evidenced herein. The contractor shall protect and save harmless the owner against suit on account of alleged or actual infringement. The contractor shall pay all royalties and/or license fees required on account of patented articles or processes, whether the patent rights are evidenced hereinafter.

ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS

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

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

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

d. Projects involving local funding may be subject also to county and municipal building codes and inspection by local authorities. The Contractor shall pay the cost of these permits and inspections as noted in the specifications.

ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC

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

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

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

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

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

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

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

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

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

ARTICLE 12 - SEDIMENTATION POLLUTION CONTROL ACT OF 1973

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

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

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

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

ARTICLE 13 - INSPECTION OF THE WORK

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

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

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

re-inspection all costs associated with additional inspections shall be borne by the contractor.

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

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

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

ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE

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

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

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

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

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

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

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

    2. Maintain a project progress schedule for all contractors.

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

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

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

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

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

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

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

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

The CPM schedule will identify and describe each activity, state the duration of each activity, the calendar dates for the early and late start and the early and late finish of each activity, and clearly highlight all activities on the critical path. "Total float" and "free float" shall be indicated for all activities. Float time shall not be considered for the exclusive use or benefit of either the Owner or the Contractor, but must be allocated in the best interest of completing the Work within the Contract time. Extensions to the Contract time, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change.

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

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

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

j. The several contractors shall be responsible for their work activities and shall notify the project expediter of any necessary changes or adjustments to their work. The project Expediter shall maintain the project construction schedule, making biweekly adjustments, updates, corrections, etc., that are necessary to finish the project within the Contract time, keeping all contractors and the designer fully informed. Copy of a bar chart schedule annotated to show the current progress shall be submitted by the Contractor(s) to the designer, along with monthly request for payment. For project requiring CPM schedule, the Contractor shall submit a biweekly report of the status of all activities. The bar chart schedule or biweekly status report shall show the actual Work completed to date in comparison with the original Work scheduled for all activities. If any activities of the work of several contractors are behind schedule, the contractor must indicate in writing, what measures will be taken to bring each such activity back on schedule and to ensure that the Contract Completion Date is not exceeded. A plan of action and recovery schedule shall be developed and submitted to the designer by the Project Expediter, when (1) the contractor's report indicates delays, that are in the opinion of the designer or the owner, of sufficient magnitude that the contractor's ability to complete the work by the scheduled completion is brought into question: (2) the updated construction schedule is thirty (30) days behind the planned or baseline schedule and no legitimate time extensions, as determined by the designer, are in process; and (3) the contractor desires to make changes in the logic (sequencing of work) or the planned duration of future activities of the CPM schedule which, in the opinion of the designer or the owner, are of a major nature. The plan of action, when required shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written demand. The recovery schedule, when required, shall be submitted to the Owner within five (5) calendar days of the Contractor's receiving the Owner's written demand. Failure to provide an updated construction schedule or a recovery schedule may be grounds for rejection of payment applications or withholding of funds as set forth in Article 33.

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

l. Designation as project expediter entails an additional project control responsibility and does not alter in any way the responsibility of the contractor so designated, nor the responsibility of the other contractors involved in the project. The project expeditor's superintendent(s) shall be in attendance at the project site at all times when work is in progress unless conditions are beyond the control of the contractor or until termination of the contract in accordance with the contract documents. It is understood that such superintendent shall be acceptable to the owner and designer and shall be the one who will be continued in that capacity for the duration of the project unless he ceases to be on the contractor's payroll or the owner otherwise agrees. The time commitment of the project superintendent to the project shall be such as to insure satisfactory construction

progress & coordination as determined by the project designer and owner and may be as stipulated in the Supplementary General Conditions.

ARTICLE 15 - SEPARATE CONTRACTS AND CONTRACTOR RELATIONSHIPS

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

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

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

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

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

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

ARTICLE 16 - SUBCONTRACTS AND SUBCONTRACTORS

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

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

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

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

ARTICLE 17 - CONTRACTOR AND SUBCONTRACTOR RELATIONSHIPS

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

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

b. Within seven days of receipt by the prime contractor of each periodic or final payment, the prime contractor shall pay the subcontractor based on work completed or service

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

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

d. Nothing in this section shall prevent the prime contractor at the time of application and certification to the owner from withholding application and certification to the owner for payment to the subcontractor for unsatisfactory job progress; defective construction not remedied; disputed work; third-party claims filed or reasonable evidence that claim will be filed; failure of subcontractor to make timely payments for labor, equipment and materials; damage to prime contractor or another subcontractor; reasonable evidence that subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by owner.

ARTICLE 18 - DESIGNER'S STATUS

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

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

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

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

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

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

ARTICLE 19 - CHANGES IN THE WORK

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

b. Except in an emergency endangering life or property, no change shall be made by the contractor except upon receipt of an approved change order or written field order from the designer, countersigned by the owner. No claim for adjustments of the contract price shall be valid unless this procedure is followed.
A field order, transmitted by fax or hand-delivered, may be used where the change involved impacts the critical path of the work. A formal change order shall be issued as expeditiously as possible.

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

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

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

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

d. Under Paragraph b and c.2. above, the allowances for overhead and profit combined shall be as follows: all contractors (the single contracting entity (prime), his subcontractors (first tier), or their subcontractors (second tier, third tier, etc.) shall be allowed a maximum of ten percent (10%) on work they each self-perform; the prime contractor shall be allowed a maximum of five percent (5%) on contracted work of his first tier subcontractor; first tier, second tier, third tier, etc. subcontractors shall be allowed a maximum of two and one-half percent (2.5%) on the contracted work of their subcontractors. Under c.1. no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under c.2. and b. above, the contractor shall include no less than five percent (5%) profit, but no allowances for overhead.

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

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

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

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

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

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

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

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

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

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

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

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

j. If, during the progress of the work, the owner requests a change order and the contractor's terms are unacceptable, the owner may require the contractor to perform such work on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the designer or owner a correct account of the cost together with all proper invoices, payrolls and supporting data. Upon completion of the work a change order will be prepared with allowances for overhead and profit per paragraph d. above and “net cost” and “cost” per paragraph c. above. Without prejudice, nothing in this paragraph shall preclude the owner from performing or having performed that portion of the work requested in the change order.

ARTICLE 20 - CLAIMS FOR EXTRA COST

a. Should the contractor consider that as a result of instructions given by the designer, he is entitled to extra cost above that stated in the contract, he shall give written notice thereof to the designer within seven (7) days. The written notice shall clearly state that a claim for extra cost is being made and shall provide a detailed justification for the extra cost. The contractor shall not proceed with the work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article 19(b) and Article 11(h). No claims for extra compensation shall be considered unless the claim is so made. The designer shall render a written decision within seven (7) days of receipt of claim.

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

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

1. A contractor who has not completed a contract with an institution of The University of North Carolina and who has not received the amount he claims is due under the contract may submit a verified written claim to the Associate Vice President for Finance & University Property Officer of The University of North Carolina System Office for the amount the contractor claims is due. If the claim remains unresolved after review by the Associate Vice President for Finance, the contractor may submit the verified written claim to the Director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The

Director may deny, allow or compromise the claim, in whole or in part. A claim under this subsection is not a contested case under Chapter 150B of the General Statutes.

2. (a) A contractor who has completed a contract with an institution of University of North Carolina for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the Associate Vice President for Finance & University Property Officer of The University of North Carolina System Office for the amount the contractor claims is due. If the claim remains unresolved after review by the Associate Vice President for Finance, the contractor may submit the verified written claim to the Director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The claim shall be submitted within sixty (60) days after the contractor receives a final statement of the Associate Vice President's disposition of his claim and shall state the factual basis for the claim.

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

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

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

ARTICLE 21 - MINOR CHANGES IN THE WORK

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

ARTICLE 22 - UNCORRECTED FAULTY WORK

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

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

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

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

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

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

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

e. Request for extension of time shall be made in writing to the designer with copies to the owner within twenty (20) days following cause of delay. In case of continuing cause for delay, the contractor shall notify the designer in writing with copies to the owner of the

delay within twenty (20) days of the beginning of the delay and only one claim is necessary.

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

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

ARTICLE 24 - PARTIAL UTILIZATION BENEFICIAL OCCUPANCY

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

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

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

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

3. Contractor will obtain consent of surety.

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

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

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

ARTICLE 25 - FINAL INSPECTION, ACCEPTANCE AND PROJECT CLOSEOUT

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

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

1. That the project is completed and accepted.

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

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

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

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

e The final acceptance date will establish the following:

1. The beginning of guarantees and warranties period.

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

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

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

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

ARTICLE 26 - CORRECTION OF WORK BEFORE FINAL PAYMENT

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

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

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

ARTICLE 27 - CORRECTION OF WORK AFTER FINAL PAYMENT

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

ARTICLE 28 - OWNER'S RIGHT TO DO WORK

If, during the progress of the work or during the period of guarantee, the contractor fails to prosecute the work properly or to perform any provision of the contract, the owner, after seven (7) days' written notice sent by certified mail, return receipt requested, to the contractor from the designer, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the contractor, such action and cost of same having been first approved by the designer. Should the cost of such action of the owner exceed the amount due or to become due the contractor, then the contractor or his surety, or both, shall be liable for and shall pay to the owner the amount of said excess.

ARTICLE 29 - ANNULMENT OF CONTRACT

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

said contract in an acceptable manner. All costs and charges incurred by the owner, together with the costs of completing the work under contract, shall be deducted from any monies due or which may become due said contractor and surety. In case the expense so incurred by the owner shall be less than the sum which would have been payable under the contract, if it had been completed by said contractor, then the said contractor and surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the contract, then the contractor and the surety shall be liable and shall pay to the owner the amount of said excess.

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

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

b. The owner shall be liable to the contractor for the cost of all materials delivered and work performed on this contract plus ten (10) percent overhead and profit and shall make such payment. The designer shall be the judge as to the correctness of such payment.

ARTICLE 31 - REQUEST FOR PAYMENT

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

    1. Total of contract including change orders.

    2. Value of work completed to date.

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

    4. Less previous payments.

    5. Current amount due.

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

c. Prior to submitting the first request, the contractor shall prepare for the designer a schedule showing a breakdown of the contract price into values of the various parts of the work, so arranged as to facilitate payments to subcontractors in accordance with Article 17, Contractor and Subcontractor Relationships. The contractor(s) shall list the

value of each subcontractor and supplier, identifying each minority business subcontractor and supplier as listed in Affidavit C, if applicable.

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

e. On projects requiring a Critical Path Method (CPM) construction schedule, the project expediter will submit with each monthly pay application to the designer a current CPM schedule in a computerized precedence network format on a compact disc. The schedule will include all construction activities to be accomplished during the project to be properly sequenced and coordinated with elements of the work. The schedule shall be assembled from input presented and mutually coordinated by all the contractors (and/or subcontractors) and integrated into a single, overall schedule. The project expediter will show all the scheduled work activities, including their subcontractors, and the sequence and interdependence (predecessors and successors) of the activities. The schedule shall show the total project duration including milestone dates. The critical path shall be clearly indicated. The schedule shall be in such a format that it can be read (imported) in Microsoft Project or Primavera P6. Failure to submit the construction schedule on compact disc media in an acceptable format will result in the pay application being denied.

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

ARTICLE 32 - CERTIFICATES OF PAYMENT AND FINAL PAYMENT

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

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

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

    2. Faulty work or materials appearing after final payment.

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

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

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

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

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

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

    3. Record of Owner's training.

    4. Resolution of any final inspection discrepancies.

    5. Granting access to contractor's records, if owner's internal auditors have made a request for such access pursuant to Article 52.

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

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

    2. Affidavit of Release of Liens.

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

    4. Consent of Surety to Final Payment.

5. Certificates of state agencies required by state law.

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

ARTICLE 33 - PAYMENTS WITHHELD

a. The designer with the approval of the owner may withhold payment for the following reasons:

1. Faulty work not corrected.

2. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.

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

b. The owner may authorize the withholding of payment for the following reasons:

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

2. Evidence that subcontractors have not been paid.

c. The owner may withhold all or a portion of the contractor's general conditions costs set forth in the approved schedule of values if the contractor has failed to comply with: (1) a request to access its records by the owner's internal auditors pursuant to Article 52; (2) a request for a plan of action and/or recovery schedule under Article 14j; (3) a request to provide electronic copies of contractor's baseline schedule and/or updates with all logic used to create schedules in the original format of the scheduling software; and (4) contractor's failure to have its superintendent on the project as provided in Article14.l and/or as stipulated in the Supplementary General Conditions.

d. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the contractor without cause will make owner liable for payment of interest to the contractor in accordance with G.S. 143-134.1. As provided in G.S. 143-134.1(e) the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progress, defective construction not remedied, disputed work, or third party-claims filed against the owner or reasonable evidence that a third-party claim will be filed.

ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS

The work under this contract shall not commence until the contractor has obtained all required insurance and verifying certificates of insurance have been approved in writing by the owner. These certificates shall document that coverage afforded under the policies will not be cancelled, reduced in amount or coverages eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the owner of such alteration or cancellation. If endorsements are needed to comply with the

notification or other requirements of this article copies of the endorsements shall be submitted with the certificates.

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

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

b. **Public Liability and Property Damage**

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

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

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

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

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

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

d. **Deductible**

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

e. **Other Insurance**

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

f. **Proof of Carriage**

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

ARTICLE 35 - PERFORMANCE BOND AND PAYMENT BOND

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

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

ARTICLE 36 - CONTRACTOR'S AFFIDAVIT

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

ARTICLE 37 - ASSIGNMENTS

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

ARTICLE 38 - USE OF PREMISES

a. The contractor(s) shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the designer and owner and shall not exceed those established limits in his operations.

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

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

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

ARTICLE 39 - CUTTING, PATCHING AND DIGGING

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

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

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

ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

j. The General Contractor shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the use of a resident inspector, should the designer so direct.

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

l. The General Contractor will erect one sign on the project if required. The sign shall be of sound construction, and shall be neatly lettered with black letters on white background. The sign shall bear the name of the project, and the names of prime contractors on the project, and the name of the designer and consultants. Directional signs may be erected on the owner's property subject to approval of the owner with respect to size, style and location of such directional signs. Such signs may bear the name

of the contractor and a directional symbol. No other signs will be permitted except by permission of the owner.

ARTICLE 41 - CLEANING UP

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

b. The General Contractor shall provide and maintain suitable all-weather access to the building.

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

ARTICLE 42 - GUARANTEE

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

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

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

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

ARTICLE 43 - CODES AND STANDARDS

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

ARTICLE 44 - INDEMNIFICATION

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

ARTICLE 45 - TAXES

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

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

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

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

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

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

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

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

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

Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the

sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.

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

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

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

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

ARTICLE 46 - EQUAL OPPORTUNITY CLAUSE

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

ARTICLE 47 - EMPLOYMENT OF INDIVIDUALS WITH DISABILITIES

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

ARTICLE 48 - ASBESTOS-CONTAINING MATERIALS (ACM)

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

ARTICLE 49 - MINORITY BUSINESS PARTICIPATION

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

ARTICLE 50 – CONTRACTOR EVALUATION

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

ARTICLE 51- GIFTS

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

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

ARTICLE 52 – AUDITING – ACCESS TO PERSONS AND RECORDS

In accordance with General Statute.147-64.7, the State Auditor shall have access to the contractor's officers, employees, agents and/or other persons in control of and/or responsible for the contractor's records that relate to this contract for purposes of conducting audits under the referenced statute. The owner's internal auditors shall also have the right to access and copy the contractor's records relating to the contract and project during the term of the contract and within two years following the completion of the project/close out of the contract to verify accounts, accuracy, information, calculations and/or data affecting and/ or relating to contractor's requests for payment, requests for change orders, change orders, claims for extra work, requests for time extensions and related claims for delay/extended general conditions costs, claims for lost productivity, claims for lost efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, and/or any other type of claim for payment or damages from the owner and/or the owner's project representatives.

ARTICLE 53 – NORTH CAROLINA FALSE CLAIMS ACT

The North Carolina False Claims Act (NCFCA), General Statute 1-605 through 1-618, applies to this contract. The contractor should familiarize itself with the entire NCFCA and its applicability to any requests, demands and/or claims for payment submitted to the State through the contracting university or affiliate.

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

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

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

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

- Liability – "Any person who commits any of the following acts shall be liable to the State for three times the amount of damages that the State sustains because of the act of that person[:] …(1) Knowingly presents or causes to be presented a false or fraudulent claim for payment or approval. (2) Knowingly makes, uses, or causes to be made or used, a false record or statement material to a false or fraudulent claim. (3) Conspires to commit a violation of subdivision (1), (2) …" (Section 1-607(a)(1), (2).)

- The NCFCA shall be interpreted and construed so as to be consistent with the federal False Claims Act, 31 U.S.C. 3729, et seq., and any subsequent amendments to that act. (Section 1-616©.)

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

ARTICLE 54 – TERMINATION FOR CONVENIENCE

a. The owner may, at any time and for any reason terminate the contractor's services and work at the owner's convenience. Upon receipt of such notice, the contractor shall, unless the notice directs otherwise, immediately discontinue the work and placing orders for materials, facilities and supplies in connection with the performance of this agreement.
b. Upon such termination, the contractor shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this agreement; plus, (2) such other costs actually incurred by the contractor as are permitted by the prime contract and approved by the owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to the contractor prior to the date of the termination of this agreement. The contractor shall not be entitled to any claim or claim of lien against the owner for any additional compensation or damages in the event of such termination and payment.

SECTION 004010

SUPPLEMENTARY GENERAL CONDITIONS

UNC – Chapel Hill
SUPPLEMENTARY GENERAL CONDITIONS

1. TIME OF COMPLETION/LIQUIDATED DAMAGES

The Contractor shall commence work to be performed under this Contract on the date to be specified in the Notice to Proceed from the Designer and shall fully complete all work hereunder within **224** consecutive calendar days from the date specified in the Notice to Proceed.

For each day beyond the above-specified completion date or for each day in excess of the above number of days, the Contractor shall pay the Owner the amount of **$500** per day as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner should the Contractor fail to complete the Work within the time specified.

If the Contractor is delayed at any time in the progress of the Contractor's work by any act or negligence of the Owner, the Owner's employees or the Owner's separate Contractor; by changes ordered in the work; by abnormal weather conditions; by any causes beyond the Contractor's control; or by other causes deemed justifiable by Owner, then the contract time may be reasonably extended in a written order from the Owner upon written request from the Contractor within ten (10) days following the cause for delay.

2. PROPOSED CONSTRUCTION SCHEDULE:

Refer to schedule in Project Information section located above before the Bid Form.

3. PAYMENTS

As the project progresses, all invoices shall be electronically submitted to the Designer of Record and copied to UNC Construction Manager for review and approval. All invoices shall show the University Facilities Services Project Number and the Purchase Order number.

Use AIA form G702 for pay applications. Include G703 Continuation Sheet showing description of work, scheduled value, work completed, stored materials, total completed and stored to date, percent completed and balance to finish. Each pay app shall include the MBE Appendix E form reflecting current payments and proposed pay amount commitment.

Facilities Construction Department
Chris Glenn (UNC Construction Manager)
Telephone: 919-201-6649
Email: chris.glenn@facilities.unc.edu

4. **ROOFING GUARANTEE**

The following paragraph is hereby added and shall become a part of the Guarantee of the General Conditions of the Contract. The substitution of an equal or longer term manufacturer's warranty in lieu of this requirement will not be accepted.

The Roofing Contractor shall warrant the materials and workmanship of the roofing system against leakage and against defects due to faulty materials, workmanship and contract negligence for a period of two (2) years following acceptance of the project by the Owner."

The Roofing System Manufacturer shall inspect the installation and warrant the materials and workmanship of the roofing system against leakage for a minimum period of ten (10) years following acceptance of the project by the Owner.

5. **UTILITIES**

The Owner will provide water and electricity to the extent they are available at the project site.

The Owner will provide restroom facilities to the extent they are available at the project site.
OR
The Contractor's personnel may not use toilet or washroom facilities in the existing building.

The Contractor shall be responsible for procedures for making temporary disruptions to existing utilities serving the building, and roads and pedestrian walks shall be planned well in advance of the work and the work shall be executed in a manner to provide reasonably continuous service throughout the construction period. Interruptions of service shall be coordinated with the Construction Manager at least Fourteen (14) days in advance.

6. **SECURITY**

Contractor shall coordinate security requirements with the Construction Manager.

Keys are made available for contractor access to areas in the project as required. Contact the Construction Manager to sign keys out from the UNC key shop. Loss of keys will result in Contractor paying the cost of rekeying areas affected by loss of key. This can be quite costly if ME or building master key. Keys must be returned to key shop for renewal every 30 days. Return receipt for keys must accompany final pay application.

7. **USE OF SITE**

Work under this contract shall be performed in such a manner as to avoid interruption or interference with the operation of any existing activity on the premises or at the location of the work.

While on campus, Contractor's and Sub-Contractor's personnel shall be identifiable at all times, for example, by wearing company names or logos on garments or hard hats.

Damage done to the University premises that are under the control of the Contractor, or damage caused by the contractor to premises used by the contractor, shall be corrected at the Contractor's expense.

The contractor shall schedule deliveries to avoid peak traffic hours which are from 7:00 to 9:00 am and from 3:00 to 6:00 pm. The contractor shall notify UNC's Dept. of Public Safety of any deliveries of equipment, material or road work that will impede the flow of vehicular or pedestrian traffic. The contractor shall provide traffic control by certified traffic control personnel (vehicular and pedestrian) during these deliveries. Staging for multiple concrete / steel / other large material deliveries, crane and other large pieces of equipment must be coordinated with the Dept. of Public Safety. Walks, streets, and drives are most congested with pedestrians at the top of the hour, when making deliveries the carrier should be made aware of this and plan his deliveries accordingly.

A minimum five working days' notice must be given to Public Safety to block parking spaces, drives, roads, streets and pedestrian walks.

Roads, streets, drives, fire lanes must remain open at all times. Adequate clearance must be maintained for emergency vehicles to negotiate the drive. Chapel Hill Fire Department requires a minimum of 20 feet for fire lanes. Construction vehicles are not allowed to block, park, or stage in a fire lanes. Vehicles blocking fire lanes will be ticketed and towed at the Contractor's expense.

Construction fences should be covered with fabric screening unless it blocks the view of oncoming traffic. Construction gates will swing into the construction area. The construction fences should not obstruct pedestrian or vehicle traffic unless alternate ways were designed in the site drawings and approved by DPS.

The Owner may enforce additional restrictions during certain periods of the year.
"Specify other restrictions on when Contractor may perform work" During examination periods, if the project involves work in or near a building in which an examination is being conducted, the Contractor shall be required to restrict operation which are disturbing to students during the hours of the exam(s). Work may not be permitted on Graduation Day, or the day preceding it (Saturday), or on University Day (Oct 12).

The Contractor will provide additional cleanup and warning signs and barricades if deemed necessary by the Owner. Any work to be performed in occupied Residence Halls may be subject to further restrictions.

The Contractor's scheduling and staging requirements must be coordinated with, and approved by, the Construction Manager.

The work shall be performed during the Owner's normal working hours, 8:00 a.m. – 5:00 p.m., Monday – Friday. Requests by the Contractor to work outside normal working hours shall be made in advance to the Construction Manager. The Contractor's bid shall include all costs associated with workers working outside of normal business hours and/or costs associated with workers working overtime as required to meet specified project schedule. The Owner reserves the right to request work to be performed outside normal working hours and to limit contractor activities when they conflict with Owner operations. Any increased costs due to Owner requirements for work outside normal hours not specified in the Contract Documents will be negotiated.

Contractors working for the University are required to comply with The University of North Carolina at Chapel Hill "No Smoking Policy", which is provided herein and hereby incorporated and made a part of this contract.

8. **PARKING**

Parking for two ***(or less)*** company vehicles will be provided in the vicinity of the project site for the portion of the project when the contractor is actively working on site. All vehicles shall be clearly identified as belonging to the Contractor and/or his Subcontractors and shall display parking permits. There will be no parking outside approved parking areas. Failure to adhere to parking regulations and /or approved designated

location will result in citations being issued. Additional parking may be purchased by contractor thru Town of Chapel Hill, surrounding businesses and occasionally UNC Public Safety Office.

9. **WORK OR MATERIALS PROVIDED BY OWNER**

The Owner will provide the following in connection with this project:

- Signage is to be provided by contractor to conform with the University signage guidelines. This will include exterior / egress signs, restroom signs, accessible pathways and parking.
- Toilet accessories for contractor to install.
- Fire Alarm: UNC-CH Life Safety Shop Responsibilities:
  - Submittal to be Peer reviewed by UNC Life Safety Shop Supervisor.
  - UNC Life Safety will witness the contractor's test of the Fire Alarm system at project final inspection for NFPA Certifications. The GC representative, HVAC controls subcontractor, Fire alarm subcontractor, and engineer of record must all be in attendance to witness the test, make corrections as required, and then sign the NFPA Certification.
- 2 systems Academic MSPO / Tele/Data: UNC-CH Telecom (or their subcontractor) will terminate all tele/data cabling, furnish and install all devices. The Electrical Contractor shall provide all infrastructure, including conduit, raceway, j-boxes and pull string. Electrical contractor will pull all cabling to box locations. Cabling will be provided by ITS.
- Building Commissioning will be coordinated and reviewed thru UNC Commissioning team
  - HVAC control submittals will be Peer reviewed by UNC Commissioning team

10. **ALTERNATES**

" NONE"

11. **UNIT PRICES**

"NONE"

12. **PERFORMANCE AND PAYMENT BONDS**

Bonds will be required for this project.

Contractor shall furnish a Performance Bond and Payment Bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form bound with these specifications (Forms 307 & 308). An authorized agent of the bonding company who is licensed to do business in North Carolina shall countersign all bonds.

13. **SUBCONTRACTING**

All subcontractors shall be identified in writing and approved by the Owner prior to the start of work.

14. **SEDIMENTATION POLLUTION CONTROL ACT OF 1973**

Any land-disturbing activity performed by the Contractor in connection with the project shall comply with all erosion control measures set forth in the Contract Documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of

1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).

Upon receipt of notice that a land-disturbing activity is in violation of said Act, the Contractor shall be responsible for ensuring that all steps or actions necessary to bring the project in compliance with said Act are promptly taken.

The Contractor shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this section.

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

15. **SUBMITTAL DATA**

The submittal requirements are described in Section 5 of the General Conditions. Items for which submittals are required are listed below and included in the project specifications:

- Exterior Brick (sample + product data)
- Powder Coated Perforated Aluminum Guardrail Panels (sample + product data)
- Galvanized Metal Stair Tread Planks (sample + product data)
- Stainless Steel Handrails (sample + product data)
- Roof Joint Seals (sample + product data)
- Exterior Wall Joint Seals (sample + product data)
- Expansion Joint Cover Plate (sample + product data)
- Aluminum Frame Entry Doors and Storefront (sample + product data)
- Metal Composite Wall Panels (sample + product data)
- Finish Hardware
- Acoustical Ceiling System
- Carpet Tile (sample + product data)
- Ceramic Tile (sample + product data)
- Luxury Vinyl Tile (sample + product data)
- High Performance Coatings (sample + product data)
- Elevator Interior Finishes and Devices (samples)
- Electrical & Mechanical Items referenced in Technical Specifications
- Site staging plan with limits, access control (fences require double padlock security, UNC will provide one for limited access and GC the other)
- Safety Plan, to include signage, all barriers
- Engineered sealed shoring plan when needed
- Confined space plan
- Erosion Control plan
- Construction Schedule once notice to proceed is issued and updated weekly
- Schedule of Values – clearly indicting General Conditions and project components
- Contact list of your team include all your subcontractors and job title.
- All Utility shutdowns and disruptive deliveries must be scheduled - typically require Minimum 7 days advance notice to CM and impacted stakeholders. The contractor shall define limits of areas to be

impacted by shutdowns and access needs prior to coordinating with project team.

- Scheduling Commissioning. The subcontractor shall assure the all work is fully completed and the GC will verify and then schedule the Engineer of record to review, GC shall complete and have all punch list inspected and completed before requesting UNC Commission for final inspection.

  - UNC Commissioning and UNC shop to be invited for overhead inspection prior to installing insulation, request inspection via UNC CM and designer of record, typically require Minimum 7 days advance notice.

- Contractor is required to maintain Logs of
  - Change Order (CO),
  - material submittals and status,
  - requests for information (RFI)
  - wet weather or other delays for applicable projects.
- Contractor is required to maintain a complete and current set of drawings, specifications, approved submittals and shop drawings on site at all times.
- All proposed change orders shall be submitted using the UNC Change Order form provided by UNC Construction Manager. Provide an excel review copy for CM and designer review, on approval email a signed PDF and including the excel version.
- Covid-19 letter
  - Provide a copy of your companies COVID-19 Exposure Prevention Plan on the jobsites.
  - If you do not have one, please develop one. Identify the Project name(s), Project ID and the Contractor's name, contact email and cell number for each project.
- See attached Provided by UNC CM
  - See attached email for COVID Notification guideline, Hot Work Policy, Appendix E, Change Order Form.

Required at Bid opening

- Signed and Dated Bid \Acceptance Form
- Required MBE documentation

Required prior to Award of contract

- Certificate of Insurance per section 19 of the General Conditions
  Clarification Insurance options allowed.
  Must show Builder's Risk or Installation Floater insurance at 100% of the construction contract amount.
  certificate holder address as Follows:
  State of North Carolina through the
  University of North Carolina
  at Chapel Hill
  103 Airport Drive CB#1090
  Chapel Hill, NC 27599

Required at project closeout

Contractor submittal:

1. Certificate for Payment (AIA Doc G702 or Equivalent) Include. Appendix E.
2. Prime Contractor's Affidavit of Payment (Section 317 or AIA G706)
3. Release of Liens – (Section 316 or AIA Doc G706A)
4. Article 36 Statement ("hold harmless") OR Releases & Waives from each Sub & Supplier with a list
5. When applicable, submit a Consent of Surety – Code/Item Only (AIA Doc G707)
6. Receipt of Electrical Certification and NFPA 72 signed or other NFPA applicable

7. Return Keys to UNC Lock Shop and submit receipt for all keys, gate, one card of Med. School passes with Final Pay App and O&M closeout docs.
8. Two (2) bound copies in 3 ring binder of O&M Manuals for any equipment requiring a submittal (include a flash drive paper clipped to a ring of each binder)
9. O&M manuals shall include an Index sheet with all Warranties and Guarantees, O&M for products and equipment including cutsheets, material, reports, certifications.
10. Submit one paper copy of the redlines with one digital copy to the designer of record for as-builts, and designer will review and submit to CM for archiving.
11. One (1) Bound copy of Controls as-built and electronic graphics interface for EMCS.

Designer submittal:

The project Architect or Designer of Record shall provide a sealed and signed Certificate of Completion with all required attachments such as Cancellation of Builder's Risk Insurance and the State Construction Office "Project Acceptance Approval" letter. And each consultant

(Architect or Engineer) involved in this project shall provide a sealed and signed Certificate of Compliance. Under GS133-1.1 any other Architect or Engineer providing professional services shall also provide a Certificate of Compliance.

1. SCO Certificate of Compliance
2. SCO Certificate of Completion
3. UNC Final Inspection Form Under $2 Million 2020
4. CAD As-builts
5. Issue CAD floor plans to GC and Controls subcontractor for creation of controls graphics
6. TAB report and control graphics shall be submitted to UNC commissioning Team for review and acceptance and EMCS notified final graphics are uploaded to server.

16. **HAZARDOUS MATERIALS**

The Owner has attempted to remove or identify all hazardous materials to be removed within this project. There may be other hazardous materials in the work area that, if not disturbed, do not create an exposure hazard. If the Contractor discovers the presence of hazardous materials or suspects that hazardous materials are present, he shall stop work immediately, secure the area, and notify the Construction Manager.

If project includes abatement, Data on the following items must be sent to the Project Manager for review and approval. The submittal process is described in Section 5 of the General Terms and Conditions. Refer to "Technical Specifications" for required submittals. All Pre-Submittals shall be delivered to the Project Manager no later than the Preconstruction Meeting. The Project Manager shall receive all Post-Submittals within two (2) weeks of work completion. The final invoice shall be included with Post-Submittals.

17. **MINORITY BUSINESS PARTICIPATION**

Refer to General Conditions #26 above. In addition to the $100,000 to $500,000 limits specified in the attached *Guidelines for Recruitment and Selection of Minority Businesses for Participation in University of North Carolina Construction Contracts*, regardless of dollar amount, all UNC-CH projects will require compliance including submission of the Identification of Minority Business Participation, Affidavits A, or B forms with the bid submission. Affidavits C, or D form will be requested from the apparent low bidder during the award process. UNC's Appendix E will be submitted with each pay application.

All questions related to MBE shall be directed to Tanya Vogel (tjvogel@fac.unc.edu) - Email is the preferred way to communicate.

THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
NO SMOKING POLICY

I. POLICY STATEMENT

The University of North Carolina at Chapel Hill (the "University") is dedicated to maintaining a healthy work and learning environment. While the University already prohibits smoking inside its buildings and facilities, beginning January 1, 2008, the policy will expand to prohibit smoking in State-owned vehicles and in the outdoor areas controlled by the University up to 100 feet from University facilities, according to the attached map. E-cigarettes are governed by this policy as well.

Specifically, this policy is intended to eliminate the potential for exposure to secondhand smoke and the practical effect of this policy is that the campus is smoke free. The University supports employees' and students' efforts to quit smoking and offers resources for smoking cessation as indicated on both the Environment Health and Safety website (http://www.ehs.unc.edu) and the Campus Health Services website (http://campushealth.unc.edu/).

II. APPLICABILITY

This policy applies to all University visitors, patients, students, and employees, including faculty, EPA non-faculty, staff, and student employees. It is the responsibility of every member of the University community to conduct himself or herself in compliance with this policy.

III. SIGNAGE

The University will post signs about the policy appropriately throughout campus. Additional information can be printed out from the websites listed above and shared with anyone who has questions about this policy.

IV. ENFORCEMENT

Smoking must not occur within the no smoking areas as designated by signage. All smoking materials must be disposed of in the appropriate receptacles.

Visitors, patients, and students who violate the no smoking policy should be reminded of the policy and asked to comply by putting out the lighted tobacco product. If a student refuses to comply with the policy, the Dean of Students' office should be contacted. That office will follow up with the student regarding the policy and available resources.

Any University employee who violates the no smoking policy should be reminded of the policy and asked to comply by putting out the lighted tobacco product. If an employee refuses to comply with the policy, the departmental representative will notify the immediate supervisor of the noncompliant employee. The immediate supervisor will follow-up with the employee to remind him/her about the policy and available resources. Continuing violations may also result in appropriate corrective action under the applicable disciplinary policy.

V. DEPARTMENT/UNIT PROCEDURES

All University departments and work units must establish procedures that include identification of the employee(s) responsible for understanding the policy, being able to educate visitors, patients, students, and employees, and assisting in enforcement, as needed. The Office of Human Resources can assist departments in developing their procedures


Map Symbols
100' No Smoking Buffer
Medical Campus Tobacco Free Zone
UNC Buildings
UNC Construction Buildings
Playing Fields
N
THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL
Engineering Information Services
Map Created: 8/21/2007

SECTION 004010

FORM OF PROPOSAL

F O R M O F P R O P O S A L

Caldwell Hall Accessibilty Upgrades | Contract: General Construction

University of North Carolina at Chapel Hill | Bidder: _____

SCO-ID 22-25217-02A | Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

The Bidder proposes and agrees if this proposal is accepted to contract with the State of North Carolina through the University of North Carolina in Chapel Hill in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of the **UNC Caldwell Hall Accessibilty Upgrades** project in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the State of North Carolina, the University of North Carolina in Chapel Hill and REID Architecture PLLC with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents, for the sum of:

SINGLE PRIME CONTRACT:

Base Bid:

_____ Dollars($) _____

General Subcontractor: _____ Lic _____

Plumbing Subcontractor: _____ Lic _____

Mechanical Subcontractor: _____ Lic _____

Electrical Subcontractor: _____ Lic _____

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

ALTERNATES:

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" or "deducted from" the base bid. (Strike out "Add" or "Deduct" as appropriate.)

GENERAL CONTRACT:

Alternate No. 1 Removal of Single Use Restroom Scope Price ($) _____

Alternate No. 2 Removal of VLT Tile Replacement Scope Price ($) _____

UNIT PRICES

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents.

GENERAL CONTRACT:

No. 1 N/A (*Unit*) Unit Price ($)_____

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work there under within the time specified in the Supplementary General Conditions Article 23. Applicable liquidated damages amount is also stated in the Supplementary General Conditions Article 23.

MINORITY BUSINESS PARTICIPATION REQUIREMENTS

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.

NOTE: A contractor that performs all of the work with its own workforce may submit an Affidavit (**B)** to that effect in lieu of Affidavit (**A)** required above. The MB Participation Form must still be submitted even if there is zero participation.

After the bid opening - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (**C**) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

*** OR ***

If less than the 10% goal, Affidavit (**D**) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

Note: Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, vendors and suppliers that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

Proposal Signature Page

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of _____

_____
(Name of firm or corporation making bid)

WITNESS:

_____
(Proprietorship or Partnership)

By: _____
Signature

Name: _____
Print or type

Title _____
(Owner/Partner/Pres./V.Pres)

Address _____

_____

ATTEST:

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

License No. _____

Federal I.D. No. _____

Email Address: _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 3 _____ Addendum No. 5 _____ Addendum No. 6 _____

Addendum No. 2 _____ Addendum No. 4 _____ Addendum No. 6 _____ Addendum No. 7 _____

SECTION 006010

FORM OF BID BOND

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS THAT _____ _____ as principal, and _____, as surety, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto the State of North Carolina* through _____ as obligee, in the penal sum of _____ DOLLARS, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this ____ day of _____ 20__

WHEREAS, the said principal is herewith submitting proposal for and the principal desires to file this bid bond in lieu of making the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the principal shall be awarded the contract for which the bid is submitted and shall execute the contract and give bond for the faithful performance thereof within ten days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so execute such contract and give performance bond as required by G.S. 143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further, that the bid may be withdrawn as provided by G.S. 143-129.1

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

***(**Community college projects: Delete State of North Carolina as owner and replace with community college name.)

SECTION 007010

GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES

IN UNIVERSITY OF NORTH CAROLINA CONSTRUCTION CONTRACTS

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Facilities Services HUB Pre-Bid Review for Projects $30K+

- UNC Chapel Hill abides by G.S. 143-128.2 which has a verifiable 10% goal for participation by minority or socially and economically disadvantaged businesses in the total value of work for each State building project.

- Minority is defined as a citizen or lawful permanent resident of U.S. who is: Black, Hispanic, Asian American, American Indian or Female. Socially and economically disadvantaged person is defined by 15 U.S.C 637.

- To be considered toward the statutory goal of 10%, minority businesses must be **certified by the State HUB Office.**

  - To verify certification prior to submitting a bid package, please go to https://evp.nc.gov/

  - If not currently certified, it is recommended that minority businesses become certified by the State HUB Office. For information, please go to https://ncadmin.nc.gov/divisions/historically-underutilized-businesses-hub/certifications

- Designers, Contractors and Subcontractors are reminded to carefully read the State Minority Guidelines and forms that are in the specifications. Each has responsibilities outlined within.

- **For Construction Contracts $30K+ ALL BIDDERS MUST SUBMIT WITH THEIR BID:**

  - **Identification of HUB Certified/Minority Business Participation Form.**

    -AND-

  - State of NC **Affidavit A** – ***Listing of Good Faith Efforts*** ***(must total 50 points for bid to be considered responsive).***

    -OR-

  - State of NC **Affidavit B** – ***Intent to Perform Contract with Own Workforce.***

    The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

- **Within 72 hours of notification of being named the apparent lowest responsible, responsive bidder, provide one of the following:**

  - State of NC **Affidavit C** – ***Portion of the Work to be Performed by HUB Certified/Minority Businesses*** if the work to be executed by HUB firms is **equal to or greater than 10%** of bidder's **total contract price**.
    -OR-
  - State of NC **Affidavit D** – ***Good Faith Efforts*** if work to be executed by HUB firms **is less than 10%** of bidder's **total contract price**. All evidentiary documents to prove Good Faith Efforts as outlined in paragraphs A-I on the form must also be provided.

- **Appendix E** – ***MBE Documentation for Contract Payments*** must be submitted along with each Payment Application and FINAL Payment Request.

- Specific questions regarding HUB guidelines or forms, please contact Tanya Vogel at tjvogel@fac.unc.edu, 919-843-1424.

- HUB resources can be found at https://facilities.unc.edu/resources/historically-underutilized-businesses/.

- For sample forms please visit: https://facilities.unc.edu/resources/historically-underutilized-businesses/pre-bid-review/ .

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be ($)_____.

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of_____

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ❑ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ❑ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ❑ **3** – **(15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ **5** – **(10 pts)** Attended prebid meetings scheduled by the public owner.
- ❑ **6** – **(20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ❑ **8** – **(25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ❑ **9** – **(20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ❑ **10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

Do not submit with bid Do not submit with bid Do not submit with bid Do not submit with bid

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

SEAL

Signature:_____

Title:_____

State of _____, County of _____
Subscribed and sworn to before me this _____day of _____20____
Notary Public_____
My commission expires_____

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

SECTION 008010

FORM OF CONSTRUCTION CONTRACT

FORM OF CONSTRUCTION CONTRACT

(ALL PRIME CONTRACTS)

THIS AGREEMENT, made the _____ day of _____ in the year of 20__ by and between _____

_____

hereinafter called the Party of the First Part and the State of North Carolina, through the University of North Carolina in Chapel Hill, hereinafter called the Party of the Second Part.

WITNESSETH:

That the Party of the First Part and the Party of the Second Part for the consideration herein named agree as follows:

1. Scope of Work: The Party of the First Part shall furnish and deliver all of the materials, and perform all of the work in the manner and form as provided by the following enumerated plans, specifications and documents, which are attached hereto and made a part thereof as if fully contained herein: advertisement; Instructions to Bidders; General Conditions; Supplementary General Conditions; specifications; accepted proposal; contract; performance bond; payment bond; power of attorney; workmen's compensation; public liability; property damage and builder's risk insurance certificates; approval of attorney general; certificate by the Office of State Budget and Management, and drawings, titled:

UNC Chapel Hill Caldwell Hall Accessibility Upgrades
SCO ID#: 22-25217-02A
240 East Cameron Avenue, Chapel Hill, NC 27514

_____

Consisting of the following sheets:

_____

G-000 COVER SHEET
G-001 STATE CODE SUMMARY
G-002 ADA DIAGRAMS AND KEYS
G-210 GROUND FLOOR LIFE SAFETY PLAN
G-211 FIRST FLOOR LIFE SAFETY PLAN
G-212 SECOND FLOOR LIFE SAFETY PLAN
A-101 SITE PLAN
A-110 GROUND FLOOR PLAN
A-111 FIRST FLOOR PLAN
A-112 SECOND FLOOR PLAN
A-113 ROOF PLAN
A-114 FIRST FLOOR FINISH PLAN
A-115 SECOND FLOOR FINISH PLAN
AD120 FIRST AND SECOND FLOOR DEMO PLANS
A-121 GROUND AND FIRST FLOOR PLANS
A-122 SECOND AND ROOF PLANS
A-123 FOUNDATION PLAN
A-124 GROUND AND FIRST FLOOR FINISH PLANS
A-125 SECOND FLOOR FINISH PLAN
A-130 GROUND AND FIRST FLOOR RCP / LIGHTING PLANS
A-131 SECOND FLOOR RCP / LIGHTING PLANS
A-310 SOUTH AND NORTH EXTERIOR ELEVATIONS

A-311 EAST AND WEST EXTERIOR ELEVATIONS
A-320 EAST AND SOUTH ADDITION ELEVATIONS
A-321 WEST AND NORTH ADDITION ELEVATIONS
A-410 BUILDING SECTIONS
A-420 ADDITION SECTION
A-421 ADDITION SECTION
A-430 WALL SECTIONS
A-431 WALL SECTIONS
A-432 WALL SECTIONS
A-433 WALL SECTIONS
A-500 EGRESS STAIR PLANS
A-501 EGRESS STAIR SECTIONS
A-502 EGRESS STAIR SECTIONS
A-510 MRL TRACTION ELEVATOR
A-520 BATHROOM PLAN AND ELEVATIONS
A-530 ELEVATOR CONTROL ROOM PLAN AND ELEVATIONS
A-540 ADDITION ELEVATIONS
A-700 SCHEDULES
A-701 GUARDRAIL ELEVATIONS
A-702 PANEL FACADE ELEVATIONS
A-800 WALL TYPES
A-810 BRICK WALL DETAILS
A-820 GUARDRAIL DETAILS
A-830 EGRESS STAIR DETAILS
A-840 ROOF GUARDRAIL DETAILS
A-841 ROOF HATCH DETAILS
A-850 SECTION DETAILS
A-851 SECTION DETAILS
A-853 PLAN DETAILS
A-860 AXONOMETRICS

S-001 COVER SHEET
S-002 GENERAL STRUCTURAL NOTES GENERAL
S-003 GENERAL STRUCTURAL NOTES REINFORCED CONCRETE
S-004 GENERAL STRUCTURAL NOTES STRUCTURAL STEEL
S-005 STRUCTURAL DESIGN CRITERIA
S-006 STRUCTURAL DESIGN CRITERIA
S-007 STRUCTURAL TESTING AND SPECIAL INSPECTION
S-008 STRUCTURAL TESTING AND SPECIAL INSPECTION
S-100 FOUNDATION & GROUND FLOOR FRAMING PLANS
S-101 1ST FLOOR & 2ND FLOOR FRAMING PLANS
S-102 ROOF FRAMING PLAN
S-200 BUILDING ELEVATIONS
S-201 BUILDING ELEVATIONS
S-202 STAIR SECTIONS
S-203 STAIR SECTIONS
S-204 GROUND LEVEL SECTIONS
S-205 ROOF SECTIONS
S-206 BRICK SUPPORT STRUCTURE ELEVATIONS
S-400 BEARING SLAB ON GROUND TYPICAL DETAILS
S-401 WALL TYPICAL DETAILS
S-402 WALL TYPICAL DETAILS
S-403 REINFORCED CMU WALL TYPICAL DETAILS
S-404 STEEL COLUMN SCHEDULE
S-405 STEEL BASE PLATE TYPICAL DETAILS

S-406 STEEL/METAL DECK TYPICAL DETAILS
S-407 HANDRAIL & PLANK TYPICAL DETAILS

P-100 PLUMBING COVER
P-101 GROUND FLOOR - PLUMBING
P-102 FIRST & SECOND FLOOR PLUMBING
P-500 PIPE HANGER DETAILS
P-600 PLUMBING ISOMETRIC
P-601 PLUMBING SCHEDULES

M-100 MECHANICAL COVER
M-101 FIRST & SECOND FLOORS - MECHANICAL
M-102 ROOF PLAN - MECHANICAL
M-500 MECHANICAL DETAILS
M-501 MECHANICAL DETAILS

E-001 ELECTRICAL LEGEND AND SCHEDULES
E-002 ELECTRICAL DETAILS AND SCHEDULES
E-003 ELECTRICAL DETAILS AND SCHEDULES
E-004 ELECTRICAL DETAILS AND SCHEDULES
E-101 ELECTRICAL LIGHTING PLANS - GROUND AND FIRST FLOOR
E-102 ELECTRICAL LIGHTING PLAN - SECOND FLOOR
E-201 ELECTRICAL POWER PLAN - GROUND FLOOR
E-202 ELECTRICAL POWER PLAN - FIRST FLOOR
E-203 ELECTRICAL POWER PLAN - SECOND FLOOR
E-204 ELECTRICAL POWER PLAN - ROOF

C-001 TITLE SHEET
C-010 LEGEND
C-020 GENERAL NOTES
C-101 EXISTING TOPOGRAPHIC CONDITIONS - REFERENCE ONLY
C-102 CONSTRUCTION TRAFFIC AND PEDESTRIAN CONTROL PLAN
C-103 SITE LOGISTICS PLAN
C-104 SITE DEMOLITION PLAN
C-111 SITE LAYOUT PLAN
C-121 SITE GRADING & DRAINAGE PLAN
C-131 SITE UTILITY PLAN
C-511 CONSTRUCTION DETAILS
C-512 CONSTRUCTION DETAILS
C-701 OVERALL SOIL EROSION & SEDIMENT CONTROL PLAN
C-702 SOIL EROSION & SEDIMENT CONTROL PLAN
C-703 SOIL EROSION & SEDIMENT CONTROL NOTES & CHARTS
C-704 SOIL EROSION & SEDIMENT CONTROL DETAILS
C-705 SOIL EROSION & SEDIMENT CONTROL DETAILS

Dated: 02.28.2025 and the following addenda:

Addendum No	_____	Dated:	_____	Addendum No.	_____	Dated:	_____
Addendum No	_____	Dated:	_____	Addendum No.	_____	Dated:	_____
Addendum No	_____	Dated:	_____	Addendum No.	_____	Dated:	_____

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

2. That the Party of the First Part shall commence work to be performed under this agreement on a date to be specified in a written order of the Party of the Second Part and shall fully complete all work hereunder within _____ consecutive calendar days from said date. For each day in excess thereof, liquidated damages shall be as stated in Supplementary General Conditions. The Party of the First Part, as one of the considerations for the awarding of this contract, shall furnish to the Party of the Second Part a construction schedule setting forth planned progress of the project broken down by the various divisions or part of the work and by calendar days as outlined in Article 14 of the General Conditions of the Contract.

3. The Party of the Second Part hereby agrees to pay to the Party of the First Part for the faithful performance of this agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States as follows:

_____

_____($_____).

Summary of Contract Award:

4. In accordance with Article 31 and Article 32 of the General Conditions of the Contract, the Party of the Second Part shall review, and if approved, process the Party of the First Party's pay request within 30 days upon receipt from the Designer. The Party of the Second Part, after reviewing and approving said pay request, shall make payments to the Party of the First Part on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the First Party, less five percent (5%) of the amount of such estimate which is to be retained by the Second Party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the Second Party. The Second Party may elect to waive retainage requirements after 50 percent of the work has been satisfactorily completed on schedule as referred to in Article 31 of the General Conditions.

5. Upon submission by the First Party of evidence satisfactory to the Second Party that all payrolls, material bills and other costs incurred by the First Party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty (30) days after the completion by the First Party of all work covered by this agreement and the acceptance of such work by the Second Party.

6. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bonds hereto attached for its faithful performance, the Second Party shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds cease to be adequate to cover the performance of the work, the First Party shall, at its expense, within five (5) days after the receipt of notice from the Second Party so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Second Party. In such event no further payment to the First Party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Second Party.

7. The Party of the First Part attest that it and all of its subcontractors have fully complied with all requirements of NCGS 64 Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

IN WITNESS WHEREOF, the Parties hereto have executed this agreement on the day and date first above written in _____ counterparts, each of which shall without proof or accounting for other counterparts, be deemed an original contract.

Witness:

_____
Contractor: (Trade or Corporate Name)

_____
(Proprietorship or Partnership)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

The State of North Carolina through*

(CORPORATE SEAL)

_____
(Agency, Department or Institution)

Witness:

_____

By:_____

Title: _____

FORM OF PERFORMANCE BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness:

_____
(Proprietorship or Partnership)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

(Corporate Seal)

_____
Contractor: (Trade or Corporate Name)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

_____
(Surety Company)

Witness:

_____

By: _____

Title: _____
(Attorney in Fact)

Countersigned:

_____

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C. Regional or Branch Office Address

(Surety Corporate Seal)

FORM OF PAYMENT BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project _____

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness:

_____
Contractor: (Trade or Corporate Name)

_____
(Proprietorship or Partnership)

By: _____

Attest: (Corporation)

Title_____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

_____
(Surety Company)

Witness:

By: _____

_____

Title: _____
(Attorney in Fact)

Countersigned:

_____

(Surety Corporate Seal)

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

Sheet for Attaching Power of Attorney

Sheet for Attaching Insurance Certificates

APPROVAL OF THE ATTORNEY GENERAL

CERTIFICATION BY THE OFFICE OF STATE BUDGET AND MANAGEMENT

Provision for the payment of money to fall due and payable by the

_____

under this agreement has been provided for by allocation made and is available for the purpose of carrying out this agreement.

This _____day of _____ 20___.

Signed _____
Budget Officer

SECTION 010400

COORDINATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the project coordination as specified herein, including but not limited to, the following:
   1. General project coordination procedures.
   2. Conservation.
   3. Coordination drawings.
   4. Administrative and supervisory personnel.
   5. Cleaning and protection.

1.3 RELATED SECTIONS

A. Project meeting - Section 01202.
B. Submittals - Section 01300.
C. Materials and equipment - Section 01600.
D. Contract closeout - Section 01700.

1.4 COORDINATION

A. Coordinate construction operations included in various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
   3. Make provisions to accommodate items scheduled for later installation.
B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the owner and separate contractors where coordination of their work is required.
C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.

5. Project closeout activities.

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

1.5 SUBMITTALS

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

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

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of conditions: Require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

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

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
   1. Excessive static or dynamic loading.
   2. Excessive internal or external pressures.

3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION

SECTION 012020

PROGRESS MEETINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. To enable orderly review of progress during construction and to provide for systematic discussions of problems, the architect will conduct project meetings throughout the construction period.
B. In general, project meetings will be held bi-weekly at the job site in accordance with a mutually acceptable schedule.
C. The purpose of the project meetings is analysis of problems that might arise between the owner and the contractor relative to the execution of the work.

1.3 RELATED SECTIONS

A. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility as described in the general conditions and are not part of project meetings content.

1.4 QUALITY ASSURANCE

A. Persons designated by the contractor to attend and participate in project meetings shall have all required authority to commit the contractor to solutions as agreed upon in the project meetings.

1.5 SUBMITTALS

A. Agenda Items: To the maximum extent possible, advise the architect at least twenty-four (24) hours in advance of the project meeting regarding all items to be added to the agenda.
B. Minimum agenda
    1. Review work progress since last meeting.
    2. Note field observations, problems and decisions.
    3. Identify problems which impede planned progress.
    4. Review off-site fabrication problems.
    5. Develop corrective measures and procedures to regain schedule.
    6. Coordinate projected progress with other prime contractors.
    7. Review submittal schedules, expedite as required to maintain schedule.
C. Minutes: The contractor will compile minutes of each project meeting and will distribute copies to the Owner and the Architect. The Contractor shall make and distribute such other copies as he wishes.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 MEETING SCHEDULE

A. Coordinate with the architect as required to establish a mutually acceptable schedule for project meetings.

3.2 MEETING LOCATION

A. To the maximum extent practicable, project meetings shall be held at the job site. Provide adequate space and facilities including table, chairs, and lighting for proper conduct of meeting.

3.3 ATTENDANCE

A. To the maximum extent practicable, assign the same person or persons to represent the contractor at project meetings throughout the construction period. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspects of the work are involved.

END OF SECTION

SECTION 013400

SUBMITTALS AND SUBSTITUTIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Work Included: Make submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Individual requirements for submittals also may be described in pertinent Sections of these Specifications.

C. Work Not Included:
   1. Unrequired submittals will not be reviewed by the Architect.
   2. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the Work, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Architect.

1.2 QUALITY ASSURANCE

A. Coordination of Submittals:
   1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.
   2. Verify that each item and the submittals for it conform in all respects with the specified requirements.
   3. By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.
   4. Submit two black-line prints to Architect with one black-line and a copy of transmittal to the Consultant.

B. Substitutions:
   1. The Contract is based on the standards of quality established in the Contract Documents.
   2. Do not substitute materials, equipment, or methods unless such substitutions have been specifically approved in writing for this Work by the Architect.

C. "Or equal"
   1. Where the phrase "or equal", or "or equal as approved by Architect", occurs in the Contract Documents, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved for this Work by the Architect.
   2. The decision of the Architect shall be final.

1.3 SUMMARY

A. Sustainable Design Intent: Comply with project requirements intended to comply with the requirements of the Harvard Green Building Standards and Harvard Business School Sustainability Framework. Refer to Section 018113, SUSTAINABLE DESIGN REQUIREMENTS for certification goals and requirements.

1.4 SUBMITTALS

A. Make submittals of Shop Drawings, Samples, substitution requests, and other items in accordance with the provisions of this Section.

PART 2 PRODUCTS

2.1 SHOP DRAWINGS

A. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.

B. Type of Prints:
   1. Submit Shop Drawings in the form of one sepia transparency or vellum of each sheet plus two blue-line or black-line prints of each sheet.
   2. Blueprints will not be accepted.
C. Review comments of the Architect will be shown on the sepia transparency when it is returned to the Contractors. The Contractor may make and distribute such copies as are required for his purposes.

22. MANUFACTURER'S LITERATURE

A. Where contents of submitted literature from manufacturers includes data not is pertinent to the submittal, clearly show which portions of the contents is being submitted for review.
B. Submit the number of copies which are required to be returned, plus one copy which will be retained by the Architect.

2.3 SAMPLES

A. Provide Samples or Samples identical to the precise article proposed to be provided. Identify as described under "Identification of Submittals" below.
B. Number of Samples Required:
   1. Unless otherwise specified, submit Samples in the quantity which is required to be returned, plus one which will be retained by the Architect.
   2. By pre-arrangement in specific cases, a single Sample may be submitted for review and, when approved, be installed in the Work at a location agreed upon by the Architect.

2.4 COLORS AND PATTERNS

A. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Architect for selection.

PART 3 EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. Consecutively Number All Submittals:
   1. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
   2. On resubmittal, cite the original submittal number for reference.
B. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.
C. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.
D. Maintain an accurate submittal log for the duration of the Work, showing current status of all submittals at all times. Make the submittal log available to the Architect for his review upon request.

3.2 GROUPING OF SUBMITTALS

A. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
   1. Partial submittals may be rejected as not complying with the provisions of the Contract.
   2. The Contractor may be held liable for delays so occasioned.

3.3 TIMING FOR SUBMITTALS

A. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals and for placing orders and securing delivery.
B. In scheduling allow at least ten working days for review by the Architect following his receipt of the submittal.

3.4 ARCHITECT'S REVIEW

A. Review by the Architect does not relieve the Contractor from responsibility for errors which may exist in the submitted data.
B. Revisions:
   1. Make revisions required by the Architect.
   2. If the Contractor considers any required revision to be a change in Contract, he shall so notify the Architect.
   3. Make only those revisions directed or approved by the Architect.

END OF SECTION

SECTION 016400

PRODUCT HANDLING

PART 1 GENERAL

1.1 DESCRIPTION

A. Work Included: Protect products scheduled for use in Work by means including, but not necessarily limited to, those described in this Section.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Additional procedures also may be prescribed in other Sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 SUMMARY

A. Sustainable Design Intent: Comply with project requirements intended to comply with the requirements of the Harvard Green Building Standards and Harvard Business School Sustainability Framework. Refer to Section 018113, SUSTAINABLE DESIGN REQUIREMENTS for certification goals and requirements.

1.4 MANUFACTURERS' RECOMMENDATIONS

A. Except as otherwise approved by the Architect, determine and comply with manufacturers' recommendations on product handling, storage, and protection.

1.5 PACKAGING

A. Deliver products to the job site in their manufactures' original container, with labels intact and legible.
   1. Maintain packaged materials with seals unbroken and labels intact until time of use.
   2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

B. The Architect may reject as non-complying such material and products that do not bear identification satisfactory to the Architect as to manufacturer, grade, quality, and other pertinent information.

1.6 PROTECTION

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.

B. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.

C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the owner.

1.7 REPAIRS AND REPLACEMENTS

A. In the event of damage promptly make replacements and repairs to the approval of the Architect and at no additional cost to the owner.
B. Additional time required to secure replacements and make repairs will not be considered by the Architect to justify an extension in the Contract Time of Completion.

END OF SECTION

SECTION 024119

SELECTIVE DEMOLITION AND ALTERATION WORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the selective demolition and alteration work as shown on the drawings and/or specified herein, including but not limited to the following:
   1. Alterations, selective demolition, and removals as noted on drawings and as required to accommodate new construction.
   2. Removal of debris.
   3. Protection of existing building and spaces to remain and shoring of the structure as required for structural integrity and personal safety.
   4. Alterations, selective demolition, and removals of exterior facade where noted.
   5. Patching and refinishing of existing surfaces damaged as a result of this work.
   6. Protection.

1.3 QUALITY ASSURANCE

A. The Contractor shall comply with the requirements of all applicable Federal, State and local safety and health regulations regarding the demolition of structures including ANSI/NFPD 241-Building Construction and Demolition Operations.

B. The Contractor shall be responsible for any damage to any adjacent structures or buildings to remain.

C. Qualifications: Qualifications of Contractor for work of this Section shall not be less than ten (10) years of field experience in work of this nature.

D. Professional Engineering: The Contractor shall retain the services of a Professional Engineer licensed in the State of North Carolina, who shall design and supervise installation of all shoring.

1.4 RELATED SECTIONS

A. Alteration and removal requirements for mechanical and electrical work – Mechanical and Electrical Sections.

1.5 SUBMITTALS

A. Schedule of Demolition Operations: Submit demolition procedures and operational sequence for Architect's review prior to start of work. Submit a written request to Architect well in advance of executing any cutting or alteration which affects:
   1. The work of tying in or connecting to operational systems of the building, including electrical, mechanical and security systems.
   2. The work of the Owner or any separate Contractor.
   3. The structural value or integrity of any element of the project or of adjacent structures.
   4. The integrity or effectiveness of weather-exposed and moisture-resistant elements or systems.
   5. The efficiency, operational life, maintenance, or safety of operational elements or systems.

B. Notice of Differing Conditions: Submit a written notification if, during the work of demolition and cutting, conditions are discovered which significantly vary from those shown on the drawings. Do not commence work until approval of Architect.

C. Shop Drawings: Submit the following prior to starting work:
   1. Submit for Architect's information shop drawings indicating location and typical construction details of temporary dustproof and weatherproof partitions.
   2. Submit drawings of temporary structural shoring, bracing, framing or support, for the information of the Architect. Such drawings will be reviewed by the Structural Engineer for the effects of such temporary members on the structural elements to remain. These drawings shall include the reason for such temporary members, the location, the direction and magnitude of design reaction forces on existing structure, and details showing how these reaction forces will be applied to the existing structure.

a. Shop drawings shall be submitted with the Seal of the P.E. engaged by Contractor; P.E. must be licensed in the State of North Carolina.
b. The Architect will receive acknowledgment for concepts shown. Such acknowledgments shall be of the concept only and not of actual capacities or structural design and shall not in any way diminish or limit the Contractor's responsibility for the quality and performance of the work and for protecting existing structures and facilities.

1.6 SPECIAL PRECAUTION

A. Hazardous materials may be encountered during demolition operations including asbestos; comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

1.7 JOB CONDITIONS

A. Condition of Structure
1. The Contractor for the work of this Section shall be held to have visited the site, examined the premises, determined for himself the existing conditions, character of equipment and facilities needed for the performance of the work, and all matters which may in any way affect the work before submitting a bid.
a. Information regarding existing construction or conditions is based on available record drawings which may or may not truly reflect existing conditions. Such information is included on the assumption that it may be of interest to the Contractor, but the Architect, Owner and their consultants do not assume responsibility for its accuracy or completeness.
b. Notify the Architect if, during the course of demolition, conditions are discovered which significantly vary from those shown on the drawings. Do not proceed until authorized by Architect.
2. The Contractor shall accept the condition of the site and structures as found. The Architect and Owner assume no responsibility for condition of site or structures nor the continuation of the condition existing at time of bidding or thereafter.

B. Areas of building to be demolished or altered will be vacated and discontinued in use prior to the start of the work.

C. Partial Removal
1. Items of savable value to the Contractor may be removed from the structure as the work progresses. Salvaged items must be transported from the site as they are removed.
2. Storage or sale of removed items on the site will not be permitted.

D. Explosives: The use of explosives will not be permitted.

E. Traffic
1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Utilities
1. Refer to Division 22 and 26 of the specifications for special requirements concerning utilities and services.
2. Maintain any existing utilities required to remain; keep in service and protect against damage during demolition operations.
3. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to the governing authorities.
4. Disconnect and seal any abandoned utilities before starting demolition operations. Coordinate all work with local utility companies having jurisdiction.

1.8 SCHEDULING

A. Before commencing any alteration or demolition work, submit for review by the Architect, and approval of the Owner, a schedule showing the commencement, the order, and the completion dates for the various parts of this work.

B. Before starting any work relating to existing utilities (electrical, sewer, water, heat, gas, fire lines, etc.) that will temporarily discontinue or disrupt service to the structures to remain, notify the Architect and the Owner 7 days in advance and obtain the Owner's approval in writing before proceeding with this phase of the work.

PART 2 PRODUCTS

Refer to Part 3 - Execution, for Product Requirements

PART 3 EXECUTION

3.1 PROTECTION

A. Take full precautions to protect workmen, passersby or any other persons from falling debris and other hazards of demolition operations.
B. Execute demolition work to ensure protection of existing portions of building to remain against damages which might occur from falling debris or other cause. Do not interfere with use of adjacent occupied buildings and areas. Maintain free, safe passage to and from occupied adjacent buildings.
C. Materials Placement: Do not load structure with weight that will endanger, overload or cause excessive deflection of the existing structure, or that will damage finished surfaces adjacent to and/or supported by the existing structure, except portions being removed.
D. Construction Operations: Do not employ any construction operation, equipment or vehicles that will endanger, overload or cause excessive deflection of the existing structure, or that will damage finished surfaces adjacent to and/or supported by the existing structure, except portions being removed.
E. Take precautions to guard against movement, settlement, damage, or collapse of any part of building, sidewalks, adjacent property or street passages; be liable for any such movement, settlement or collapse. If such damage does accidentally occur, Contractor shall repair promptly at no cost to Owner.
F. Provide the necessary safeguards to prevent accidents, to avoid all necessary hazards and protect the public, the work and property at all times, including Saturdays, Sundays, and holidays.
G. Be responsible for any and all damages which may arise or occur to any party whatsoever by reason of the neglect in providing proper lights, guards, barriers, or any other safeguards to prevent damage to property, life and limb.
H. Make such explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. Give particular attention to shoring and bracing requirements so as to prevent any damage to existing construction.
    1. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain. The Contractor's Professional Engineer shall advise on bracing, shoring, or other structural requirements. The Contractor shall bear all responsibility for prevention of movement or other structural fault.
    2. The Contractor shall restore, by repair or otherwise, the portions of structure or their contents altered by the Contractor in furtherance of his underpinning and support operations. Restoration shall be completed to the conditions which existed prior to the start of the work. Any damage caused by inadequate support shall also be restored by the Contractor at no cost to the Owner.
I. Provide, erect, and maintain catch platforms, lights, barriers, weather protection, warning signs, and other items as required for proper protection of the workmen engaged in demolition and alteration operations, occupants of the building, public and adjacent property. Any damage caused by the Contractor's operations shall be promptly repaired by the Contractor at no cost to the Owner.
J. Provide and maintain temporary protection of the existing structure designated to remain where demolition, removal, and new work are being done, connections made, materials handled, or equipment moved.
K. Take necessary precautions to prevent dust and dirt from rising. Protect unaltered portions of the existing building affected by the operations under this Section by dustproof partitions and other adequate means.
L. Provide adequate fire protection in accordance with local Fire Department requirements.
M. Do not close or obstruct walkways, passageways, or stairways. Do not store or place materials in passageways, stairs, or other means of egress. Conduct operations with minimum traffic interference.
N. Be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.
O. Promptly repair damages caused to adjacent facilities by demolition operations at no cost to the Owner.
P. Provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

3.2 INSPECTION

A. Verify that areas of demolition work are protected, and temporary dustproof partitions have been installed.
B. Verify that construction to be removed is not load bearing or has been properly braced, framed, or supported.
C. Inspect existing conditions of the project, including elements subject to damage or to movement during demolition and cutting.
D. After uncovering work, inspect the conditions affecting the installation or performance of the work.

1. Report differing or questionable conditions to the Architect in writing; do not proceed with the work until the Architect has provided further instructions.

3.3 PREPARATION

A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work
B. Provide devices and methods to protect other portions of the project from damage.
C. Pollution Controls
   1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
      a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
   2. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to condition existing prior to the start of the work.
   3. Provide drainage for temporary water use.

3.4 DEMOLITION AND CUTTING

A. Selectively demolish existing construction in conformance with the drawings and these specifications.
   1. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surface to receive installation of work by others and patching of finish surfaces.
   2. Do all cutting or removal so as to leave neat, true, plumb and square edges, at edges to remain. Use carborundum or diamond saw equipment for cutting masonry, concrete, and stonework, where edges or surfaces are to remain.
   3. Do not cut or remove construction which might weaken or impair the structural integrity or strength of the structural framing or support systems which are to remain.
   4. Demolish and remove materials as shown on the drawings without damage to the remaining parts of the structure or mechanical/electrical/utility systems.
   5. Remove materials so as to not impose excessive loads in supporting walls, floors or framing and so as not to damage remaining undemolished portions of the structure.
   6. Where portions of structures are to be removed, remaining portions shall be protected from damage and prepared to fit new construction. Damage to portions of structures to remain shall be repaired.
   7. Reinforcing steel in existing structures shall be left in place, cleaned and aligned to provide tie with new work.
   8. Existing waterproofing systems and flashings shall be carefully exposed and protected to maintain workable conditions of fitting new work with existing construction.
   9. Proceed with demolition in a systematic manner.
   10. Demolish concrete and masonry in small sections.
B. Shoring
   1. Design, provide, erect and maintain necessary temporary shoring, bracing, framing, or support where load bearing structural or supporting members are removed or weakened by cuts or openings or are subject to damage from demolition operations, and otherwise as required for safety or to protect finish surfaces from damage.
   2. Construction and adequacy of the shoring shall be the entire responsibility of the Contractor. Any damage caused by the inadequacy of the shoring or other support shall be the responsibility of the Contractor to remedy at no additional expense to the Owner.
   3. Shoring and bracing shall remain until new structural framing and/or supports are installed. Coordinate operations fully with other trades.
   4. Be ready at any time to promptly provide, add to, or strengthen temporary shoring, bracing, or support for existing work, in case existing construction begins to show signs of structural stress.

3.5 WORKMANSHIP STANDARDS FOR ALTERATION AND REMOVAL WORK

A. Cut, remove, alter, temporarily remove and replace, or relocate existing work as required for performance of the work. Perform such work required with due care, including shoring and bracing.
B. Coordinate patching involving the various trades whether or not specifically mentioned in the respective specification Sections.
C. Materials or items demolished and not designated to become the property of the Owner or to be reinstalled shall become the property of the Contractor and shall be removed from the Owner's property.
D. Execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the adjacent buildings.

E. In general, demolish masonry in small sections. Where necessary to prevent collapse of any construction, install temporary shores, struts, or bracing.
F. Materials to be removed by existing elevators shall be put in enclosed containers.
G. Where existing equipment and/or fixtures are indicated to be reused, repair such equipment and/or fixtures and refinish to put in perfect working order. Refinish as directed.
H. Cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.
I. Confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. Cut and fold back existing roofing. Cut and remove insulation and related items. Provide temporary weathertight protection as required until new roofing and flashings are installed. Consult the Owner to ascertain if existing guarantee bonds are in force and execute the work so as not to invalidate such bonds.
J. Where utilities are removed, relocated, or abandoned, cap, valve, plug, or by-pass to make complete and working installation.
K. Restore existing pipe and duct coverings damaged by work under this Contract to original undamaged condition.
L. Immediately restore to service and repair any damage caused by Contractor's workmen to existing pipe and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems which are not scheduled for discontinuance or abandonment.
M. Upon completion of contract, deliver work complete. Damage that may be caused by Contractor or Contractor's workmen to existing structures designated to remain, grounds, and utilities shall be repaired by Contractor and left in as good condition as existed prior to damaging.
N. Restore finish work of floors, walls, and ceilings remaining in place but damaged or defaced because of demolition or alteration work to condition equal that which existed at beginning of work under this Contract.
O. Where alteration or removals expose damaged or unfinished surfaces or materials, refinish such surfaces or materials, or remove them and provide new or salvaged materials to make continuous surfaces uniform.
P. Perform new work and restore and refinish existing work in conformance with applicable requirements of the specifications, except as follows:
    1. Materials for use in repair of existing surfaces, but not otherwise specified, shall conform to the highest standards of the trade involved, and be in accordance with approved industry standards, and shall be as required to match existing surfaces.
    2. Workmanship for repair of existing materials shall, unless otherwise specified, be equal to similar workmanship existing in or adjacent to the space where the work is being done.
    3. Installation of salvaged items where no similar items exist shall be done in accordance with the highest standards of the trade involved and in accordance with approved shop drawings.
Q. Materials or items designated to become the property of the Owner shall be as shown on the drawings. Remove such items with care and store them in a location at the site to be designated by the Owner.
R. Materials or items designated to be reinstalled shall be as shown on the drawings. Remove such items with care under the supervision of the trade responsible for reinstallation; protect and store until required. Replace materials or items damaged in their removal with similar new material.
S. The existing building shall not be used as a work shop. Neither shall the furnishings or equipment in any room be used as work benches. Should any damage occur during the progress of the work to any furniture, fixtures, equipment, or appurtenances therein, such damage shall be repaired, replaced or made good by the Contractor without extra cost to the Owner.
T. Where removing existing floor finish and base, remove all adhesive and leave floors and walls smooth and flush, ready to receive new finish.
U. Finish new and adjacent existing surfaces as specified for new work. Clean existing surfaces of dirt, grease and loose paint before refinishing.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General
    1. Remove from the site debris, rubbish and other materials resulting from work of this Section.
    2. Burning of removed materials from demolished structures will not be permitted on the site.
B. Removal: Transport materials removed from demolished structures and legally dispose of offsite. Pay any and all fees associated with disposal work. Leave the site in an orderly condition to the approval of the Architect.

3.7 CLEANING UP

A. Remove debris as the work progresses. Maintain existing premises in a neat and clean condition.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 CONTRACT DOCUMENTS

A. Comply with Contract Documents:
   1. All Work of this Section shall comply with the requirements of the Conditions of the Contract (General, Supplementary and Special), with all Sections of Division 1 - General Requirements, with this Section of the Specifications, with the Drawings and with all other Contract Documents.

B. Flammable Materials or materials not conforming in all respects to the fire resistive and fire safety provisions of governing regulations shall not be left in place in the Work.

C. Disposition of and Exposure To Materials: Contractor remains fully responsible for the disposition and the exposure to persons of all materials, whether or not hazardous.

D. Volatile Organic Compounds (VOC): Contractor remains fully responsible for the supplying of products and materials complying to the VOC limitations set forth by the *Building Code* and by governing agencies having jurisdiction.

1.2 WORK INCLUDED

A. Scope: Contractor shall examine all of the Contract Documents for the extent of the Work of this Section of the Specifications. That Work shall include all labor, materials, devices, plans, tools, equipment, appliances and services necessary to complete the Work as shown in the Drawings, as specified herein, as required by job conditions, and as required by governing authorities having jurisdiction, including but not limited to the following:
   1. Designing and testing of concrete mixes. Designing of concrete mixes shall be by Contractor's Professional Engineer licensed in the project's jurisdiction.
   2. Submission of Shop Drawings, samples, supporting data, mill certificates and the like.
   3. Furnishing, fabricating and placing of all reinforcing bars, mesh, field-applied concrete anchors, metal and plastic accessories, spacers and the like.
   4. Cooperation in the making of concrete testing samples, in inspecting reinforcing steel and in all other activities related to Work of this Section.
   5. Footings, piers, walls, pits and the like.
   6. Porous fill and vapor barrier under slabs on ground.
   7. Slabs at ground, bearing and/or spanning, including stairs and equipment bases and the like.
   8. Waterstops and keys in construction joints.
   9. Boxed openings, beam pockets, seats, corbels and shelves.
   10. Grouting and concrete encasement of beam and column base plates.
   11. Concrete structure, including beams, columns, walls, slabs and parapets/curbs to thickness, depth and width indicated in Structural or in Architectural Drawings.
   12. Concrete for slabs on composite and non-composite metal deck.
   13. Concrete for metal pan stair treads and landings, including abrasive finish for exterior treads and platforms and including steel trowel finish on all treads and landings.
   14. Grouting, setting and building-in of embedded items provided under other Sections of this Specification.
   15. Providing expansion, control and construction joints in concrete Work including the surface preparation and application of bonding compound where specified.
   16. Forming and bracing of concrete Work, including both shoring and reshoring of formwork and concrete, and the subsequent removal of formwork, bracing and the like. Design of formwork shall be by Contractor's Professional Engineer licensed in the project's jurisdiction.
   17. Formwork for pockets, chases, slots, reglets, depressions and openings in concrete Work required for the installation of Work specified under other Sections of this Specification.

18. Cement mortar grouting of openings around below-grade ducts, piping and conduits passing through concrete, and of elevator door sills, plates, anchors and the like.
19. Plugging and finishing of form tie holes, where specified.
20. Filling, patching and rubbing concrete exposed to view in finished Work.
21. Finishing, curing, and protection of all concrete Work, including both hot and cold weather protection of concrete Work.
22. Cleaning of concrete exposed to view and where required to receive other materials.
23. Plugging and sealing of holes potentially or actually subject to hydrostatic pressure. Exterior walls below grade shall be plugged and sealed.
24. Provisions for other Work.
25. Cooperate with Owner, with Construction Manager, with Architect and with Testing Agency in all aspects of quality assurance and in all other activities related to the work of this Section 03 30 00.
26. The safe handling and disposition of materials related to the Work of this Section 03 30 00, whether or not hazardous.
27. All other labor, materials and Work given in the Drawings, specified herein or required to make the Work complete.

B. Work Installed as Specified Elsewhere: Contractor shall examine all of the Contract Documents for the extent of Work to be installed under this Section 03 30 00. Such work shall include, but shall not be limited to:
1. Anchor bolts, embedded plates, anchors, inserts, clips, field-applied concrete anchors and other embedded materials for structural steel and for miscellaneous metals.
2. Anchor bolts, inserts, plates, frames, isolators and other embedded items for elevators.
3. Anchor bolts, isolators, jack-up devices and inserts for equipment pads and isolation slabs.
4. Anchor bolts, inserts and other embedded items for walls, partitions, brickwork, and the like.
5. Angle edging, corner guards, curb edging and the like at platforms, pits, dock levelers and the like.
6. Inserts for attachments of hangers for ceiling support system.
7. Inserts and other devices for the support of ductwork, piping and the like.
8. Embedded stair nosings.
9. Provision for and cooperation with utility companies and with the work of other trades for the passage through concrete Work of gas, oil, storm, sewer, water, telephone and other communication systems, electrical, sprinkler, HVAC and other service lines and ducts.
10. Drainage tile, including connections to sumps and pits, in porous fill under slabs-on-ground.
11. Sleeves for penetration through concrete.
12. Provisions for electrical and lightning grounding.
13. Embedded items of other trades similar to the items listed in this Article.

1.3 RELATED WORK

A. Related Work Specified Elsewhere, Amplified Elsewhere or Included in Other Contracts:
1. Submittals: Section 01 30 00.
2. Owner's plant and field testing and inspection of concrete Work by Testing Agency engaged and paid for by Owner: Section 01 40 00.
3. Site Preparation, Earthwork, Backfilling: Section 02 20 00.
4. Porous Pipe for Foundation Drainage: Section 02 20 00.
5. Excavation and Retention System: Section 02 30 00.
6. Walkway Paving and Surfacing, Vehicular Paving: Section 02 50 00.
7. Masonry: Division 4.
8. Structural Steel: Section 05 10 00.
9. Metal Deck and Stud Shear Connectors: Section 05 30 00.
10. Miscellaneous Metals: Section 05 50 00.
11. Metal Stairs and Railings: Section 05 50 00.
12. Architectural Metals: Section 05 70 00.
13. Cementitious Waterproofing: Section 07 14 50.
14. Dampproofing: Section 07 15 00.
15. Fluid-Applied Roofing and Waterproofing: Section 07 54 00.
16. Flashings and Sheet Metal: Section 07 60 00.

17. Sealants: Section 07 90 00.
18. Special Coatings: Section 09 80 00.
19. Painting: Section 09 90 00.
20. Elevators and the like: Division 14.
21. Cement Cants in Elevator Shafts: Division 14.
22. Electrical: Division 16.
23. Furnishing of embedded items required by and specified under other Sections of this Specification.
24. Other items similar to the items listed in this Article.

1.4 APPLICABLE CODES AND STANDARDS

A. General: Except as modified or voided by requirements specified herein or by details or notes included in the Drawings, Work specified under this Section shall conform to all applicable provisions of the codes, specifications, standards and other reference documents cited in this Specification and/or noted in the Drawings.

B. Requirements of Codes and Other Reference Documents:
1. Codes, standards, specifications and other reference documents cited in this Specification are declared to be a part of this Specification, the same as if fully set forth herein. Work shall conform to the applicable provisions of reference documents cited directly by this Specification and shall conform also to codes, standards and specifications, or parts thereof, cited in codes, standards and reference documents stipulated in this Specification.
2. Where provisions of this Specification supplement those of stipulated reference documents, the applicable provisions of the stipulated document(s) plus those of this Specification shall control the Work.
3. Where provisions of this Specification modify or void provisions of stipulated reference documents, the provisions of this Specification shall govern the Work, solely or in combination with the provisions of reference documents, as applicable.
4. Recommendations and suggestions in the listed codes and standards shall be mandatory where not in conflict with this Specification.
5. In the event of conflict between provisions of stipulated reference documents and of this Specification or of another stipulated reference document, Contractor shall report in writing the details of the conflict. Decisions regarding applicability of provisions of this Specification and provisions of reference documents applied independently or as supplemented, modified or voided, will be provided in writing and shall be final. Resolution of conflicts shall conform to the procedures set forth in the General Conditions of the Contract.

C. Codes: All Work under this Section shall conform to the requirements of the 2018 North Carolina Building Code, hereinafter referred to as *Building Code*, and to the regulations of all governmental authorities having jurisdiction. Where more stringent, the following codes, standards, manuals and specifications, latest edition and revision, shall apply to the Work, all as modified herein or by *Building Code*:
1. *Standard Specification for Tolerances for Concrete Construction and Materials*, ACI 117.
2. *Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete*, ACI 211.1.
3. *Standard Practice for Selecting Proportions for Structural Lightweight Concrete*, ACI 211.2.
4. *Recommended Practice for Evaluation of Strength Test Results of Concrete*, ACI 214.
5. *Field Reference Manual: Specifications for Structural Concrete, ACI 301, with Selected ACI and ASTM References*, SP-l5. Contractor shall keep at least one full copy in the field office at all times.
6. *Guide for Measuring, Mixing, Transporting and Placing Concrete*, ACI 304.
7. *Building Code Requirements for Structural Concrete*, ACI 318 and Commentary, ACI 318R. (referred to hereinafter as ACI Code).
8. *Standard Specification for Cold Weather Concreting*, ACI 306.1.
9. *Standard Practice for Curing Concrete*, ACI 308.
10. *Guide for Consolidation of Concrete*, ACI 309.

D. Reference Documents: To the extent that the best quality of Work is provided, Work shall conform to the examples, procedures and recommendations listed below, latest edition and revision. Where provisions of the *Building Code*, this Specification, or codes, standards, manuals and specifications cited by this Specification are more restrictive or provide increased quality, the combination of provisions, examples, procedures and recommendations which provide both best quality and *Building Code* conformance shall control the Work.
   1. *ACI Detailing Manual*, SP-66 (Includes ACI 315 and ACI 315R). Note that some aspects of SP-66 are out-of-date (bar development lengths, etc.)
   2. *Cement and Concrete Terminology*, ACI 116R (SP-19).
   3. *Cooling and Insulating Systems for Mass Concrete*, ACI 207.4R.
   4. *Chemical Admixtures for Concrete*, ACI 212.3R.
   5. *Guide for Use of Normal Weight Aggregates in Concrete*, ACI 221R.
   6. *Guide for Concrete Floor and Slab Construction*, ACI 302.1R.
   7. *Placing Concrete by Pumping Methods*, ACI 304.2R.
   8. *Hot Weather Concreting*, ACI 305R.
   9. *Cold Weather Concreting*, ACI 306R.
   10. *Guide for Consolidation of Concrete*, ACI 309R.
   11. *Guide to Formwork for Concrete*, ACI 347R with the specific deletion of reference to tolerances where in conflict with this Specification. Tolerances given in ACI 117 shall apply to the Work except where less stringent than are provided under this Specification.
   12. *Manual of Standard Practice*, Concrete Reinforcing Steel Institute.
   13. Guide to Durable Concrete, ACI 201.2R.
   14. Protection of Metals in Concrete Against Corrosion, ACI 222R.

E. ASTM (American Society for Testing and Materials) Specifications cited in ACI 318, ACI 301, this Specification or in cited reference documents shall be the year of adoption or tentative adoption and revision listed in the latest edition of the Annual Book of ASTM Standards, *Index*, except that, should a specific year of adoption or revision be cited by the Contract Documents, by *Building Code*, or be proposed by Contractor and be accepted, that edition shall apply to and shall control the Work.

F. Conformance to Regulations: Work of this Section 03 30 00 shall conform to all applicable federal, state, and local laws and regulations.

1.5 SUBMITTALS

A. General: Contractor shall submit samples, Shop Drawings, product data, test reports and data, manufacturer's names, certifications, procedures, methodology statements, and the like as stipulated in the drawings, and/or in this Specification.
   1. Review of Contractor's submittals is only for the limited purpose of the examination of submittals for conformance with the design concept of the project and to assist Contractor in ascertaining that the information given in the submittals conforms to the requirements of the Contract Documents.
   2. Review of Contractor's submittals is not conducted for the purpose of determining the accuracy or the completeness of the submittal, for dimensions or quantities, or for installation or performance of the system or the piece(s) being submitted.
   3. Submittals by Contractor implies that Contractor has checked the submittal with care. Where by error or other cause, Contractor's check has not been accomplished; Contractor shall not rely on review but shall first check and shall then resubmit such material as though the submittal had been rejected.
   4. Should submittals be reviewed that are not required by the Contract Documents, Contractor shall not rely on the review of any unmarked portion of the submittal.
   5. Contractor shall maintain and, on request, shall submit full documentation of the traceability of all materials to points of origin, assembly, manufacturing and the like.

B. Shop Drawings:
   1. General: Shop Drawings, as the term is used under this Section 03 30 00, are not Contract Documents, but are intended to demonstrate the way that Contractor intends to conform to the requirements provided in the Contract Documents. Contractor may wish to use these same drawings as a part of the instructions given to craftpersons for the accomplishment of the Work.

2. Best Standards: Shop Drawings furnished under this Section shall conform to the best standards of the construction industry. Shop Drawings shall be prepared by and under the supervision of competent engineering personnel. Prior to preparation, Contractor shall retain a Professional Engineer, accepted by Construction Manager and by Structural Engineer and licensed in the project's jurisdiction, to supervise the preparation of and to check each Shop Drawing for compliance with the requirements of the Contract Documents.
   a) Shop Drawings shall be prepared under the direction of personnel completely familiar with Architectural, Mechanical, Plumbing, Electrical and other Drawings so as to avoid having concrete Work interfere with the Work of other trades.
   b) Comply with the requirements of ACI SP-66 where more stringent than is specified herein. Show bar schedules; stirrup size and spacing, drawings of bent bars, and size and arrangement of all reinforcement.
3. Shop Drawings shall be submitted for review and to governing agencies having jurisdiction for acceptance in accordance with the provisions of the Contract Documents.
4. Shop Drawings shall be submitted in parts as follows:
   a) Sleeve, Insert and Fitting Location Drawings,
   b) Construction Joint and Crack Control Joint Location and Detail Drawings,
   c) Formwork Drawings,
   d) Placing Plans and Elevations,
   e) Detail Drawings and Schedules,
   f) As required for the work of other trades,
   g) Field Work Drawings, and
5. Sleeve, Insert and Fitting Location Drawings shall clearly show the location and orientation of each item to be placed into the formwork. Include items for the Work of other trades such as elevators, dock levelers, plumbing and sprinkler systems, HVAC, electrical and the like.
6. Construction Joint and Crack Control Joint Drawings shall show the location of joints in beams, slabs, walls, columns and the like, and shall also show the sequence of pours and all else needed for the proper detailing of reinforcing steel. Show and detail waterstops, keys and the like. Indicate extent and type of bonding compound. Submit in sufficient time to allow the orderly detailing of reinforcing steel.
7. Formwork Drawings shall include plans, elevations, sections and complete details to describe clearly, at an ample scale, all Work to be provided. Drawings shall be dimensioned accurately, where applicable, and shall be notated clearly. Detail ledges, curbs, pads, trenches, openings and the like from information given in Architectural, Structural, HVAC, Plumbing, Electrical and other Contract Documents.
   a) Show in the Formwork Drawings and dimension thereon, holes required for passage of Work of other Divisions and other Sections of this Specification through Cast-In-Place Concrete Work.
   b) Contractor's Professional Engineer shall be responsible for the design of formwork. As evidence of conformance with this requirement, each Formwork Drawing shall bear the seal and signature of Contractor's Professional Engineer.
8. Placing Plans and Elevations shall show, to scale with all dimensions, all concrete Work including top of slabs and depressions, pits, curbs, trenches, pads, equipment bases, steps, slopes, radii, curves, edges of slabs, openings, sleeves, blockouts and the like. Provide schedules and details showing placing sequences, bending, lengths and locations of all reinforcement. Show elevations of all concrete walls with top and bottom elevations, openings, ledges, pockets, construction joints, and all else needed to locate correctly all reinforcement. Detail top and bottom layers of two-way slab reinforcement on separate plans. Identify all epoxy-coated and galvanized reinforcement. Indicate all lap lengths and lap locations in the placing plans.

a) Detailing of Reinforcing Steel shall recognize the arrangement and dimensioning of individual bars, including the location of bend points, hooks and the like so as to preclude interference between bars, sets of bars, and embedded items and so as to allow clear spacing and concrete cover as provided in ACI 315 and ACI 318. Prepare details and provide sections showing placement sequences to minimize congestion of reinforcing steel at splices, intersecting bars around openings and block-outs, and adjacent to embedded items. Illustrate and note correct placing arrangement and placing sequence to enable field placing crews to properly place and execute the Work. Provide sections, typical details and notes to illustrate correct location and arrangement of and clear cover for reinforcement and required placement locations. Provide suitable and necessary details and placing sequence information in Shop Drawings so as to properly instruct reinforcing steel placement personnel.

9. Detail Drawings and Schedules for reinforcing steel, including welded wire fabric (WWF), shall be prepared in strict accord with the methods and procedures provided in ACI SP-66 except that provisions of the Drawings and of this Specification shall prevail. Detail Drawings shall include bar and fabric lists; applicable bar lists shall be submitted simultaneously with related Detail Drawings. Prepare Detail Drawings which provide for reinforcement, including dowels, properly positioned in all concrete Work, so that material can be properly cut, bent and packaged from information given in Detail Drawings.
    a) Reinforcement for concrete Work shall include all reinforcement shown or scheduled in Drawings, including all reinforcement required by typical details and general notes. Provide minimum percentages of reinforcing steel required by ACI Code where such reinforcement exceeds that stipulated in Drawings.
    b) Reinforcement shall be spliced in strict accord with ACI 318. Where practical, stagger splices of adjacent bars.
    c) Unless shown specifically to the contrary, all reinforcement shall be spliced and all splices shall develop the full tensile capacity of the reinforcement. No reduction in splice length or development requirements may be taken because supplied reinforcing is larger than that required under the Contract.
    d) Lapped bars may be detailed to be placed in contact and securely wired together or may be separated in accord with ACI 318 to permit embedment of the entire surface of each bar in concrete.
    e) Extend slab, joist, beam and girder reinforcement to the far face of supports except where lesser embedment is provided explicitly in the Drawings.
10. Requirements for the Work of Other Trades: Submit detailed drawings showing requirements for the passage of reinforcement through structural steel, precast concrete, masonry and the like.
11. Field Work Drawings: Prepare Field Work Drawings depicting all field work required to accommodate field conditions.
12. Where shop drawings are submitted that include construction loads imposed on the base building structure, these drawings shall clearly show attachment details, locations with respect to project grids, as well as magnitude and direction of loadings for review. These shop drawings and supporting load calculations shall bear the seal and signature of Contractor’s Professional Engineer licensed in the project’s jurisdiction.
13. Contractor shall coordinate and cross-check for accuracy, completeness and correct relationship to the Work of other Sections, each Shop Drawing prepared for the Work of this Section, including each Shop Drawing prepared by accepted subcontractors. Pay particular attention to areas of congestion of reinforcement and to areas where reinforcement and other embedded items combine to cause congestion. Contractor's check shall include a verification of compliance with the Contract Documents and shall be performed prior to submission and resubmission of each Shop Drawing. Contractor shall certify the coordination, accuracy, and Contract compliance of each Shop Drawing by a written statement placed in each drawing and attested by the responsible person in charge of the work for Contractor. The personally inscribed initials of the person(s) preparing each shop drawing as well as the detailing agency's supervisor and chief checker shall be included in the title block or similarly prominent location.

14. Deviations: Should Contractor desire a Deviation from the Drawings or Specifications, or both, Contractor shall submit the specific Deviation in writing prior to the submittal of Shop Drawings showing the Deviation. Requests for Deviations shall be submitted on Contractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in Shop Drawings, or both, without the required written description on Contractor's letterhead, may not be accepted and shall be sufficient cause for the rejection and the return of such Shop Drawings without further action.
    a) Acceptance of Shop Drawings including Deviations not detected during Shop Drawing review, shall not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted in writing.
15. Shop Drawing Review: Only Shop Drawings marked "No Exceptions Taken" or "Make Corrections Noted - Resubmission Not Required" may be used by Contractor in the Work. Shop Drawings marked "Make Corrections Noted - Resubmit" shall be corrected or completed (or both) as required and shall be resubmitted. This process shall be repeated the number of times required to achieve the mark "No Exceptions Taken" or "Make Corrections Noted - Resubmission Not Required".
    a) Nonconformities and errors detected during review will be noted in Shop Drawings returned to Contractor upon completion of review. Acceptance of Shop Drawings including Deviations not detected during review will not relieve Contractor from sole responsibility to provide Work conforming strictly to the Contract Documents.
    b) Shop Drawing review includes engineering calculations only to the extent deemed necessary to ascertain that Contractor's Shop Drawings have been prepared by competent personnel. Contractor alone is responsible for the accuracy and the completeness of Contractor's engineering calculations.
    c) Review of Contractor's Shop Drawings does not include a review of bills of materials and the like. Accordingly, information required for the review of Shop Drawings shall be contained outside of bills of materials and the like.
16. Resubmission of Shop Drawings: Prior to resubmission of Shop Drawings with additions, deletions, or corrections, Contractor shall circle and identify all changes from the prior issue. Drawings submitted without each change both circled and identified clearly will be returned and shall be resubmitted as though the original submittal had been rejected. Each submittal, whether or not accepted or rejected, shall contain a unique revision number, clearly identified.

C. Product Data: Submit printed manufacturer's literature for each manufactured item specified under Part 2 - Products, along with test data as may be requested. Include detailed instructions for application and installation.

D. Names of Manufacturers/Suppliers: Submit for acceptance the names of the following products along with certification that the products conform in all respects to the requirements of the Contract Documents:
1. cement
2. aggregates
3. admixtures
4. silica fume (microsilica), fly ash, blast furnace slag, and other natural pozzolans
5. fibrous reinforcement
6. ready-mix concrete
7. form sealers and release agents
8. form-ties
9. reinforcing bars, including galvanized and epoxy-coated reinforcing bars
10. steel welded wire fabric, including galvanized and epoxy coated welded wire fabric
11. reinforcing bar mechanical connections
12. deformed bar anchors
13. non-shrink grout and epoxy grout
14. bonding compound and epoxy adhesive
15. polymer patching/feathering compound
16. drill-in anchors
17. self-drilling fasteners
18. expansion dowels
19. dovetail slots
20. hanger inserts and wedge inserts
21. flashing reglets

22. waterstops
23. polyurethane sealant
24. joint filler and compressible filler
25. bearings
26. curing paper
27. vapor barrier
28. composite drain material, geotextile filter fabric
29. curing and sealing, strippable curing compound, and liquid/sealer densifier
30. evaporation retarder
31. surface retarder
32. waterproofing and chloride ion screen
33. concrete cleaning/finishing solution
34. other products, material and fixtures, as specified herein

E. Mill Tests: Submit certified mill test reports for cement, for steel reinforcement, including bars, welded wire fabric and dowels. Provide also to governing agencies having jurisdiction.
   1. Mill test reports shall state clearly the governing ASTM specification and shall be certified and notarized by Contractor as conforming in all respects to that specification.

F. Epoxy Coating Plant Certification: Submit copy of current CRSI Epoxy Coating Plant Certification.

G. Reinforcing Bar Mechanical Connections: Obtain from manufacturer and submit a certified affidavit indicating compatibility of reinforcement, including bar deformations, with mechanical connection assemblies.

H. Certification for Curing Compounds and Sealers, Hardeners, Dustproofing, etc.: Submit certificate of compatibility with concrete and with materials to be applied to concrete surface.

I. Certification for Admixtures: Submit notarized document of compatibility of each admixture with all other concrete ingredients and with each applicable concrete surface treatment.

J. Design Mixes as provided in Part 2 of this Specification. Submit proposed mix designs for both concrete and grout on the Mix Design Submittal Form included with this specification. Submit test results and other supporting data on each mix design.

K. Concrete Ready-Mix Plant Quality Control Procedure:
   1. Organization description for both plant and job site.
   2. Plant locations.
   3. Plant description: plant type, degree of automation, batching equipment, testing equipment, mixing equipment, plant capacity and the like.
   4. Inspection, calibration and maintenance of batching equipment, testing equipment and mixer trucks.
   5. Materials selection, control, handling, storage and traceability.
   6. Materials testing standards, testing procedures and frequency of testing.
   7. Materials measuring, batch sequencing and mixing time.
   8. Concrete testing standards, testing procedures and frequency of testing.
   9. Batch/truck ticket samples.
   10. Transporting Methodology: driver procedures, advanced notice, delivery time constraints, delivery routes and the like.
   11. Contingency plans in case of plant shut down during concrete placement operation.

L. Post-Installed Anchor Certificates: Submit approved independent testing report per ACI 355 (ICC-ES report), Manufacturer’s Printed Installation Instructions, letter describing installation procedures, and installer qualifications including certification for horizontal and overhead adhesive installation where applicable.

M. Protective Measures: Contractor's construction procedures shall be typewritten and shall include charts and diagrams, as applicable and necessary, to explain fully the proposed procedures, methods, equipment and operations in order to allow review, assist the Testing Agency's evaluation of the Work, and to allow Contractor's personnel to perform Work in full conformance to the Contract Documents. Submit procedures for the following:

1. Both hot, normal and cold weather concreting procedures shall be submitted not less than four weeks before beginning the Work of this Section, regardless of the need for the immediate implementation of such procedures. Procedures shall include hot weather cooling systems, cold weather heating systems, insulation, enclosures, provisions for mass concrete work and the like. Finishing procedures and timing and duration of curing shall be described.
2. Protection of concrete against injury due to mechanical contact and construction operations.
3. Welding of reinforcing bars and dowels.
4. Protection of curtain wall and other systems.
5. Protection of waterproofing and the like.
6. Protection of Work by other trades.
7. Formwork removal and reshoring procedures. Procedures unique to hot and cold weather conditions shall be identified. Shoring and reshoring drawings and calculations shall be prepared under the supervision of and signed by Contractor's Professional Engineer.

N. As-built Shop Drawings: At the completion of the Work, provide to Owner, to Architect and to Structural Engineer, one complete digital set of all Shop Drawings (including field changes, Field Work Drawings, and the like), so as to provide as-built drawings of finished and completed Work under this Section 03 30 00.

O. Governing Agencies: Provide all drawings, tests, inspections, reports, affidavits, manufacturer's certifications, certification of compliance with VOC limits, and other requirements and data to governing agencies having jurisdiction.

1.6 MEASUREMENTS AND TOLERANCES

A. Measurements:
1. Field Measurements: Obtain all field measurements required for proper fabrication and installation of Work covered by this Section 03 30 00. Submit, prior to installation, all measurements indicating discrepancies from Drawings. Describe in writing and, where applicable, by sketches proposed methods of correcting discrepancies. Measurements are the responsibility of Contractor.
2. Lay out each part of the Work in strict accordance with the Architectural, Structural, Mechanical, Electrical, Plumbing and all other Drawings and be responsible for correct location of same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.
3. Field Survey: Provide all field survey measurements required by Construction Manager for coordination with other trades installation.

B. Allowable Tolerances: Conform to the requirements listed below and as given in ACI 117, whichever is more stringent; provide more restrictive tolerances where required to meet job conditions and *Building Code*. Tolerances indicated shall apply to the full height of the building. Variations from grade and flatness of Work may be measured prior to removal of supporting formwork or shores and shall be taken as either plus or minus from a true line.
1. Concrete work around elevator shafts, including slabs, beams, columns and walls, shall not fall more than 1/2 inch away from theoretical locations.
2. Variations from Plumb:
   a) lines and surfaces of columns, piers, walls, corners and the like:
      1/4 inch per 10 feet;
      1 inch per 40 feet or more; and
      1 inch maximum for the entire height.
   b) exposed column, control joint grooves, and other conspicuous lines shall correspond at all locations, and shall not exceed:
      1/4 inch per 20 feet;
      3/8 inch per 30 feet; and
      1/2 inch per 40 feet and larger
3. Level Alignment:
   a) Elevation of top of slab (both slab-on-ground and suspended slabs), 3/4 inch.
   b) Elevation of formed surfaces before removal of shores, 3/4 inch.
   c) Lintels, sills, parapets, horizontal grooves and other lines exposed to view, 1/2 inch.

4. Relative Alignment:
   a) Stairs
      i) Difference in height between adjacent risers, 1/8 inch.
      ii) Difference in width between adjacent treads, ¼ inch.
   b) Unless otherwise noted, formed surfaces may slope with respect to the specified plane at a rate not to exceed:
      i) 1/4 inch in 10 feet.
      ii) for lintels, sills, parapets, horizontal grooves and other lines and surfaces exposed to view, 1/4 inch in 20 feet.
5. Building Lines: Variations of the linear building lines from established position in plan and related positions of columns, walls, beams and partitions:
   1/4 inch in 10 feet;
   3/8 inch in 20 feet;
   1/2 inch in 40 feet; and
   1 inch maximum.
6. Faces of formed slab edges, turned down spandrels, and parapets shall not deviate from theoretical position or alignment by more than the distance in consideration divided by 500 or by 1/2 inch, whichever is less.
7. Sleeves and Openings: Variations of the sizes and locations of sleeves, floor and wall openings and the like shall not exceed minus 1/4 inch or plus 1 inch from size and 1/2 inch from centerline locations given in accepted Shop Drawings.
8. Anchors and Inserts: Variations in the location of anchors and inserts shall not deviate more than 3/8 inch vertically nor 1/4 inch horizontally from positions shown in accepted Shop Drawings.
9. Cross-Sectional Dimensions of columns and beams and the thicknesses of slabs and walls shall not deviate from theoretical by more than the following:
   a) for dimensions of
      12 inches or less ..... +3/8 in., -0 in.
   b) for dimensions of more than
      12 inches but not over
      36 inches ..... +1/2 in., -3/8 in.
   c) for dimensions over
      36 inches ..... +1 in., -3/4 in.
10. Footings and Pile Caps shall vary in plan dimension from theoretical by not more than -0.5 inch nor more than +2 inches . The center of gravity shall be within 2 percent of the theoretical footing dimension but, in no case, shall deviate from theoretical by more than 2 inches. Footings and pile caps shall not be reduced in thickness by more than 5 percent of the specified thickness but, in no case, shall the thickness be less than the theoretical by more than 3 inches.
11. Exterior and interior column and wall forms shall be braced during the forming, concrete placement and curing stages so as to produce column and wall straightness and vertical alignment which does not deviate from theoretical position by more than specified tolerances.

1.7 TESTING AND INSPECTION

A. Owner's Testing Agency: All Work is subject to controlled inspection as required by *Building Code*. Subject to acceptance by Architect, Owner will engage and pay for the services of an independent testing agency (Testing Agency) as outlined in Section 01 40 00, Inspection and Testing. The selected Testing Agency will meet the requirements of ASTM E 329. Contractor shall not retain Owner's Testing Agency for its own Work but may, subject to acceptance, contract through Owner for such work. The activities of Testing Agency are only for the limited purpose of examining Contractor's quality assurance program for conformance with the intent of the Contract Documents. Contractor alone is responsible for the achieving of the required level of quality, both in the shop and in the field. Testing Agency will rely heavily on reviewed Shop Drawings, as described earlier in this Specification, in its examination of as-constructed Work.

Where directed, and at the option of Owner, Testing Agency will perform the following functions, inspections and tests:

1. On instructions and at locations selected by Architect, Testing Agency may sample materials taken from the as-erected Work.
2. Take steps to ascertain that concrete is proportioned and mixed in accordance with the requirements of the Drawings and this Specification.
3. Maintain a presence at the project site during the placing of concrete.
4. Examine formwork for general conformance with the requirements of this Specification.
5. Examine as-placed reinforcing steel for general conformance with the requirements of the Drawings and of this Specification.
6. Receive and review concrete batch/truck tickets at time of delivery and prior to discharging concrete. Review of batch tickets shall include the comparison of actual material and quantities batched to mix design target values.
7. Monitor the methods of conveying concrete from the mixer to the point of placement in the Work.
8. Make, perform and evaluate testing of concrete cylinders in accord with this Specification, with ASTM C 31 and ASTM C 39, and as provided in Section 01 40 00. Capping for concrete cylinders shall be in accordance with either ASTM C 617 (bonded caps) or ASTM C 1231 (unbonded caps). High strength concrete specimens shall have their ends either saw cut or ground to the tolerances specified in ASTM C 39 prior to testing.
    a) For each class and strength of concrete take at least 5 test cylinders for each day's work, but not less than 5 test cylinders for each 100 cubic yards (75 cubic meters) of concrete nor less than 5 test cylinders for each 4300 square feet (400 square meters) of surface area for slabs or walls. Of each set of 5 test cylinders, one will be tested at 7 days, two at 28 days and, where 28 day cylinders fail to conform to the requirements of this Specification, two will be held and broken at 56 days;
    b) Where, after sampling any third portion of a truck load, the elapsed time exceeds 30 minutes, a set of 5 test cylinders will be taken from each third of the load taken at intervals greater than 30 minutes;
    c) Monitor protection systems for test cylinders; and
    d) Identify all test cylinders as to placement date and location, concrete mix type and designation number, concrete batch ticket serial number, and other pertinent data.
9. Perform slump tests in accord with ASTM C 143.
    a) Take one test at the beginning of each placement, both at the truck and at the point of discharge, one test at the taking of test cylinders and such other tests as are deemed appropriate by Testing Agency, by Construction Manager, or by Architect.
10. Perform air entrainment tests in accord with ASTM C 231 (ASTM C 173 for concrete with lightweight or high absorption aggregates).
    a) Take one test at the beginning of each placement, one test at the taking of test cylinders and such other tests as are deemed appropriate by Testing Agency, by Construction Manager, or by Architect.
11. Determine the temperature of freshly mixed concrete on a random basis during concrete placement in accord with ASTM C 1064.
12. Perform microwave tests on a random basis and as specified during concrete placement for determining the water content of freshly mixed concrete in accordance with AASHTO T318.
13. Perform drying shrinkage tests in accord with ASTM C 157 and with Part 2 of this Specification.
14. Perform restrained expansion tests for shrinkage compensating concrete in accord with ASTM C 878 and with Part 2 of this Specification.
15. Testing Agency may visit the batch plant as often as weekly, more or less often where directed. Each visit will involve one or more of the following operations:
    a) Examine aggregates for grading, cleanliness, moisture content, and the like;
    b) Examine plant operation and equipment such as stock piles, bunker loading, scales, mixer, cement, water and admixture dispensing;
    c) Review proportioning of mix, particularly for free moisture and the like; and
    d) Truck loading.
16. Perform physical testing of mechanical connections for reinforcement. In accordance with ASTM A 370, record the failure mode (bar fracture, coupler fracture, bar pull-out, etc...), maximum stress at yield, maximum load, ultimate tensile strength, elongation at failure, modulus of elasticity, diameter and area of reinforcement, and other pertinent data.

17. Test floor slab finished surface for flatness and levelness in accord with ASTM E 1155 and with this Specification.
    a) The Floor Flatness/Levelness Inspector shall be certified by the Face Companies of Norfolk, Virginia as being competent in F-Number measurement using the Dipstick Floor Profiler. This person shall have tested not less than 250,000 square feet (23,000 square meters) of floor surface using ASTM E 1155 and the F-number system.
    b) Measure slab elevations with a device capable of measuring and recording slab elevation changes of 0.002 inches (50 µm). Use Dipstick by Face Companies, F-meter by Allen Face & Company, or other accepted device.
    c) Where the area of slab surface which falls within 24 inches of construction joints exceeds 25 percent of the slab surface, the entire surface shall be tested, including those areas within 24 inches of construction joints.
    d) Complete testing within 24 hours of placement and before shores are removed, and submit results, including a key plan showing area tested, data sheets and all results required by ASTM E 1155, within 48 hours of placement. Identify clearly all defective areas. Submit to Owner, Architect and Contractor.
18. Maintain a copy of ACI 311.1R - ACI Manual of Concrete Inspection, ACI 311.4R - Guide for Concrete Inspection and ACI 311.5R - Batch Plant Inspection and Field Testing of Ready-Mixed Concrete.
19. All test reports indicating non-compliance shall be faxed or emailed immediately to all participants listed on the distribution list and the hard copy shall be sent on different colored paper.
20. Perform Special Inspection of post-installed anchors in accordance with the Building Code, Manufacturer's Printed Installation Instructions, approved independent testing report per ACI 355, Contract Documents and approved shop drawings. As a minimum, provide continuous inspection of adhesive anchors installed in horizontal, or upwardly inclined orientations, supporting tension loads; and periodic inspection of all other conditions of post-installed anchors. Special Inspectors shall be qualified (via experience, training, ACI/CRSI certification, etc.) with the installation and inspection of post-installed anchors. Special Inspections shall include but are not limited to the following:
    a) Verify installer qualifications as required per the Contract Documents;
    b) Verify anchor type, material, size, length, and condition;
    c) Verify minimum concrete age, temperature, strength, and dry condition;
    d) Verify drilling method, hole cleaning, preparation per Manufacturer's Printed Installation Instructions; and
    e) Verify anchor position, setting, and installation method.

B. Authorizations: Owner's Testing Agency will not be authorized to:
1. Authorize or accept deviations from the Contract Documents.
2. Assume any of the responsibilities of Contractor; for example, Testing Agency may not advise formally or informally on any aspect of construction means, methods, techniques, sequences or procedures, or safety precautions and programs in connection with the Work.
3. Accept Shop Drawings or samples.
4. Approve or issue a Certificate of Payment, a Change Order, or issue verbal or written instructions which modify the Contract between Owner and Contractor.

C. Responsibilities and Duties of Contractor:
1. Performance or waiving of inspection, testing or surveillance by Testing Agency for a given portion of the Work will not relieve Contractor from responsibility to conform strictly to the requirements of the Contract Documents. Inspection and testing by Testing Agency may be waived in part or in total. Contractor shall not construe performance or waiving of inspection, testing or surveillance to relieve Contractor from total responsibility to perform in strict accord with the Contract Documents.
2. To facilitate and to assist testing and inspection, Contractor shall cooperate by providing proper notice of the initiation of Work.

3. Access to Documents, Facilities and Materials: Furnish one copy of each accepted Shop Drawing and of each mill test certificate to Testing Agency. Provide reasonable office, desk and file space at each location of the Work and at the site to allow Testing Agency to work conveniently with and to maintain project records and drawings. Provide authorized personnel convenient and free access to all parts, locations and areas of Work, including storage areas. Provide hoisting, turning and moving of materials and reasonable quantities of scaffolding, power, casual labor, and other provisions and assistance necessary to allow quality and effective inspection and testing of Work.
4. Provide suitable and adequately sized storage and initial curing facilities for concrete test cylinders. Conform fully to the requirements of ASTM C 31. Provide all necessary job site facilities required to allow and assist Testing Agency to perform its tests and inspections in full conformance to all applicable standards, codes, and provisions of this Specification.
5. Notice: Provide 20 hours minimum notice of each concrete placement or other operation requiring plant or job site testing or inspection.
6. Secure and deliver to Contractor's independent testing laboratory without additional cost to Owner, representative samples of each material or ingredient required to be tested and certified prior to submittal for acceptance.
7. Reimburse Owner for the actual cost of all tests performed exclusively for the Contractor's convenience (such as job cured cylinders for early stripping of formwork) and for all tests and retests made necessary by initial nonconformance to Contract Documents.
8. Cost of Owner's Tests by Testing Agency will be borne by Owner. However, where additional tests are deemed necessary by Construction Manager or by Architect on account of failure to pass tests, the cost of additional testing will be deducted from payments to Contractor so as to reduce the Contract price.

1.8 QUALITY ASSURANCE

A. Source Quality Control: Contractor's material control procedures shall be effective and shall assure that all Work fulfills the requirements of the project as well as the applicable provisions of the Contract Documents. All materials shall be tested in accord with the requirements of *Building Code*, of Building Department, of governing authorities having jurisdiction and of this Specification.
B. Construction Site Quality Control: Contractor shall maintain, on staff, sufficient office, field engineering, and field supervision staff to assure that all data and layout drawings for Work of other Sections is transmitted to detailers to allow proper detailing of holes, penetrations, chases, and the like and to assure proper execution of the Work in the field.
   1. Formwork foreman shall be experienced in the fabrication, erection and dismantling of formwork for Architectural Concrete and for Exposed Concrete.
C. Minimum Qualifications: Fabricator, installer and detailer of reinforcing steel shall each have experience with at least five buildings of the type of this work.
   1. The reinforcing steel detailing firms shall be subject to acceptance. Detailing firms shall demonstrate in-house quality control procedures to the satisfaction of Construction Manager and of Architect. Acceptance of reinforcing steel detailer is provisional and may be withdrawn where detailing is not of sufficient quality to meet project requirements.
D. Concrete Strength: Evaluation and acceptance of concrete strength shall conform to the requirements of ACI 318. Where laboratory cured cylinder test results do not satisfy these requirements, Contractor shall make sufficient and appropriate changes to concrete proportions for the remaining Work in order to assure acceptable strength test results. Where required, Contractor shall provide also reshoring and additional curing of concrete slow in attaining design strength. Additionally, at its sole discretion, Construction Manager or Architect may permit or require core tests in accord with ASTM C 42. Load tests shall not be performed without Construction Manager's or Architect's specific concurrence, and then only after acceptance of comprehensive, detailed procedures prepared by, signed and sealed by Contractor's Professional Engineer, and submitted in writing.
   1. Core tests may be required of Contractor where:
      a) the average of one or more sets of three consecutive strength tests falls below f'c;
      b) one or more individual strength tests falls below f'c by more than 500 psi (3500 kPa);
      c) strength tests of field-cured cylinders, accomplished at the designated age, fall more than 15 percent below strength tests of companion laboratory-cured cylinders;

d) samples of concrete for acceptance test cylinders are not representative of concrete in place in the structure.

2. Perform all tests, and all corrective and restorative measures at no expense to Owner. Construction Manager and Architect shall be sole interpreter of the need for additional tests, and Construction Manager's and Architect's judgment shall be binding on Owner and Contractor alike.
3. Laboratory cured cylinders shall not be used for evaluating either compressive strength or acceptable condition of concrete suspected of being frozen, or for determining strength of concrete for early stripping of formwork.
4. Should core specimens be taken, Contractor shall plug all core holes solid with matching concrete or non-shrink grout as directed. All such plugging shall be Contractor's responsibility and shall be performed at no expense to Owner. All such work shall be subject to acceptance and to correction by Contractor, where not in conformance with the Contract Documents.

E. Qualifications: Contractor shall determine, shall warrant and shall certify that producers, epoxy coating applicator, reinforcing steel detailer, fabricator and installer, fabricator and installer, formwork constructor, concrete placer, finisher and all others involved in the Work, along with their personnel, are experienced, qualified and adequately staffed to undertake the specific Work required under this Section 03 30 00.

F. Reinforcing Bar Mechanical Connections shall be installed and torqued by workers having demonstrated experience and/or current training in manufacturer's procedures and techniques.

G. Documentation of Contract Conformance: Perform quality control functions required to achieve and to document that Work conforms to the Contract Documents. Provide access to Contractor's quality control documents and reports upon request. Provide reasonable numbers of photocopies of specific quality control reports on request.

H. Purchase Orders: Each purchase order shall identify the end use of the purchased material. Contractor shall ensure that manufacturer or vendor understands fully the intended use of the material in the Work.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Original Containers: Materials shall be delivered to the site, ready for use, in the manufacturer's original and unopened containers and packaging, bearing original labels as to type of material, brand name, and manufacturer's name. Delivered materials shall be identical to accepted samples.

B. Storage: Materials shall be stored under cover in dry, weathertight, adequately ventilated and clean locations off the ground. Storage methods shall also provide for free and rapid drainage of rainwater and shall prevent collection of water on or within stored materials.

C. Protect reinforcing steel and mesh from scaling, oil, grease and distortion. Reinforcing steel and mesh that has rusted to the extent of scaling will be rejected and may be placed in the Work only after proper cleaning, and shall be subject to acceptance.

D. Aggregates to be used in field mixed concrete or grout shall be stockpiled in separate bins or piles in a manner suitable to minimize segregation and contamination of aggregates. Field mixing is not encouraged and will be allowed only with specific written permission.

E. Removal: Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the job site and replaced with acceptable materials.

1. Construction Manager and Architect shall be the sole judge of the suitability of such materials and neither Owner nor Contractor may challenge Construction Manager's or Architect's decisions as to acceptability.

F. Batch/Truck Tickets: Provide a copy of each batch ticket for each batch of concrete discharged and used in work. Batch tickets shall be submitted to Owner or Owner's inspection agency prior to discharging concrete. Contractor shall retain duplicate tickets until such time as Owner has received a Certificate of Occupancy. Tickets need indicate the following:

1. Ready-mix batch plant name and location.
2. Project identification number, name and location.
3. Serial number of ticket.
4. Truck number.
5. Mix type and designation number.
6. Date and time of first mixing of cement and aggregates.

7. Actual material and quantities batched, both at plant and site, including total free water and admixtures. Total free water includes free water on the aggregates, water in each admixture, water and ice.
8. Amount of concrete batched.
9. Signature of plant quality control supervisor and, if water and/or admixtures are added at the site, site quality control supervisor.

1.10 JOB CONDITIONS

A. Contractor's Responsibility: Contractor shall be solely responsible for the correctness of dimensions and quantities and for the fitting to other Work; for Work to be confirmed and correlated at the site; for information pertaining to the fabrication procedure or to the means, methods, techniques, sequences and procedures of construction; and for the coordination of the Work of this Section with the Work of all other trades. The verification of the physical interrelationships of elements of the Work from Contract Documents and in the field is solely Contractor's responsibility. Review of Contractor's submissions does not relieve Contractor from these responsibilities.

B. Cooperation: Prior to starting applicable phases of the Work of this Section (i.e., Shop Drawings, formwork, reinforcing steel fabrication and placement, concrete placement, etc.), Contractor shall cooperate and coordinate with each trade affected by the Work of this Section, including areas where Work of other Specification Sections joins or relates to Work of this Section. Contractor shall report unsatisfactory or nonconforming conditions in writing prior to the start of Work.

C. Contractor's Supervision: Contractor shall provide sufficient qualified supervision, field and shop verification, and cross-checking efforts to assure that all Work conforms to the Contract Documents.

D. Contractor's Coordination: Contractor shall coordinate and schedule the Work of this Section with the Work of other Sections of this Specification in order to optimize quality and to avoid delay in overall job progress.

E. Rejection of Work: Testing Agency may inspect and test materials at the source before shipment as well as at the site before, during or after installation in the Work. Construction Manager and Architect reserve the right, at any time before final acceptance of the completed Work, to reject material not conforming with specified requirements, regardless of previous tests, inspections, acceptances, or inclusion in certificates of payment.

F. Provisions for Other Work: The Work under this Section shall include required cutting, forming, reinforcing steel and all else required for the passing through and attachment of other Work.

G. Construction Sequence: Descriptions of limitations on construction sequence are intended to assist Contractor in coordinating the Work of the Project. Descriptions do not describe fully the limitations given, do not describe all limitations, nor do they preclude construction sequences not contemplated herein. Whether or not Contractor follows the limitations on construction sequence described herein, and until such time as the structural Work is completed, Contractor remains fully responsible for both the stability and the safety of the Work; adherence to the limitations described herein does not relieve Contractor from that responsibility.
   1. Generally, the structure is to be constructed from the bottom to the top, floor-by-floor, with Contractor supplying such temporary bracing and shoring as may be required to compensate for the lack of completion of portions of the construction.
   2. Do not backfill behind earth-retaining walls until needed permanent construction or adequate shoring is in place.
   3. Plan and accomplish construction sequence in accord with Structural, Architectural, Mechanical, Electrical and all other Drawings, forming a part of the Work.
   4. Contractor’s Professional Engineer shall review and accept Contractor’s Construction Sequence. Contractor shall submit a letter, signed and sealed by Contractor’s Professional Engineer, as evidence of conformance with this requirement.

H. Construction Loads: The structure is designed to resist safely the loading prescribed by *Building Code* for the finished building. Provisions are not included for loads or stresses imposed or induced by Contractor's means and methods of construction. Design loads are provided in *Building Code* but are sometimes modified upward as provided in Structural Engineer's Design Criteria.

1. Where Contractor elects to place loads on the structure or elects to otherwise load or deform the structure in excess of the design loads, Contractor shall submit drawings and supporting calculations prepared under the supervision of and sealed by Contractor's Professional Engineer.
   a) Review of Contractor's submittal shall not relieve Contractor from full responsibility for Contractor's means and methods of construction.
2. Alternatively, Contractor may seek professional services from Structural Engineer. Such services may be obtained through Owner or, with the permission of Owner, may be obtained directly from Structural Engineer. Architect will not be involved contractually in any such services.

I. Accidents and Hazardous Conditions: Contractor shall prepare and shall submit promptly a detailed written report of all accidents and other occurrences involving death, significant personal injury and/or significant losses in tangible property.

J. Installing and Rigging Equipment: Contractor shall shore all construction susceptible to impact loading from the installation of equipment installed by other trades.
1. Such equipment shall include but shall not be limited to boilers, chillers, refrigeration equipment, pumps, transformers, elevator machines and the like.
2. Remove shoring when equipment installation is complete but not before structure has achieved design strength.

1.11 DEFICIENT WORK

A. Repairing, Patching, Cleaning: Contractor shall correct all Deficiencies in the Work of this Section 03 30 00 including areas where Testing Agency reports, or Construction Manager's or Architect's rejections have indicated that Work is not in full compliance with the Contract Documents. Perform, at no expense to Owner, all additional tests which Construction Manager or Architect deems necessary to reconfirm noncompliance of the original Work and perform, at no expense to Owner, all tests and inspections which may be necessary to show compliance of corrected Work.

B. Defective and Nonconforming Work: Defective Work, unsuitable Work, or Work otherwise failing to conform to the Contract Documents shall be made good by Contractor at no change in the amount of or the time of the Contract. Contractor shall prepare appropriate details and procedures for bringing such Work into conformance with the Contract Documents and shall submit such details and procedures for acceptance. Corrective Work, including materials, shall conform strictly to accepted details and procedures. Nonconforming Work may be rejected at any time, regardless of prior acceptance in Shop Drawings, prior inspection, inclusion in inspection or test reports, or inclusion in certificates of payment.

C. Deficiencies: Where Work exhibits any one or more of the following deficiencies, or where Work otherwise fails to conform to the requirements of the Contract Documents or to the requirements of *Building Code*, for any reason or combination of reasons, such Work shall be considered Deficient and not in conformance with the requirements of the Contract:
1. Low cylinder strength at 28 days, as defined by this Specification.
2. Excessive or deficient water, air, cement, admixture, or any other material.
3. Slump not in accord with this Specification.
4. Unauthorized addition of water.
5. Spalling, honeycombing or the like.
6. Unauthorized cutting, chopping, construction joints, cold joints and so forth.
7. Workmanship not in accord with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
8. Cracking, surface defects, or improper consolidation.
9. Exceedance of tolerances, lack of alignment, and incorrect forming.
10. Floor flatness/levelness F-numbers (either FF, FL or both) which measure less than specified minimum values.
11. Evidence of freezing, improper curing and the like.
12. Contact with aluminum or with aluminum alloys except where specifically permitted under this Specification.
13. Use of non-conforming materials or systems.
14. Post-installed anchors not set in accordance with Manufacturer’s Printed Installation Instructions, adhesive anchors not set with sufficient adhesive (no overfill visible).

D. Replacement or Repair: Where Construction Manager or Architect, at its sole discretion, finds any of the above deficiencies or other Work not in accord with the requirements of the Contract Documents, Construction Manager or Architect may order that the affected Work be replaced or repaired at Contractor's expense.
   1. Contractor shall reimburse Owner for the actual amount of the fees of Testing Agency for the reinspection and the retesting of Work deemed defective by Construction Manager or by Architect.

E. Cost: The cost of all other activities and procedures associated with defective Work shall be paid by Contractor.

1.12 PROFESSIONAL FEES AND COSTS

A. Scope: Contractor shall compensate Architect, Structural Engineer and Architect's other consultants for services incurred because of Contractor-proposed deviations (including substitutions), extra submittals of Shop Drawings, deficient and defective Work and the like. Compensation will be at the rates given in the standard time-and-expense billing policy of the firm. Architect will notify Owner, Construction Manager and Contractor prior to the commencement of services associated with each item under this Article 1.13.

B. Deviations: Contractor-proposed Deviations will be evaluated and reviewed where requested by Contractor. This service includes the evaluation and review of substitute and alternative materials, products, systems, methods and the like.

C. Shop Drawings: The review of the first and the second submittals of each Shop Drawing are normal services, but the review of the third and all subsequent submittals of each Shop Drawing will be considered an extra service and subject to the compensation provisions of this Article 1.13.

D. Deficient Work: The evaluation, review and design and all other activities associated with Deficient Work are subject to the compensation provisions of this Article 1.13.

PART 2 PRODUCTS

2.1 CONCRETE MIXTURES

A. Contractor Furnished Mix Designs: For each type and strength of concrete mixture and grout mixture required in the Work, Contractor shall submit for Architect's acceptance a mix design. Each mix design shall conform to the applicable provisions of this Specification and *Building Code*. Mix designs shall be established by Contractor's Professional Engineer licensed in the project's jurisdiction on the basis of field experience and or trial mixes prepared by Contractor and both monitored and tested by an independent testing laboratory retained and paid by Contractor. Mix designs in current use, documented by current test reports, may be submitted for acceptance in accord with ACI 301. All mix designs shall be submitted on the Mix Design Submittal Form included in this specification. This form is available electronically for Contractor's use.
   1. Contractor shall be fully responsible for conformance to all mix design and control provisions of this Specification and for all strength, consistency, and handling of concrete. Concrete supplier, and admixture manufacturer(s) shall state and certify that the proposed concrete mixes and placing procedures will produce the strengths, finishes, densities and like qualities required by this Specification.
   2. Mix designs may be adjusted by Contractor to suit minor variability of materials, job conditions, weather, test results and other data, subject to acceptance and provided there is no change in the amount of the Contract; laboratory data for revised mix designs shall be submitted and accepted prior to use in the Work.
   3. Contractor shall pay all costs associated with preparing, testing, documenting and submitting design mixes for each concrete mix design used in the Work.
   4. Contractor shall provide notification of the time and location where each trial mix will be prepared and/or tested.

B. Concrete Mix Requirements: Proportions for each mix shall provide for homogeneous, cohesive, workable and dense concrete, suitable in all respects for its intended purpose. Concrete mixes shall be selected to provide for requirements not less than those required by Table 2.1-1. All concrete shall have a maximum shrinkage of 0.04% at 28 days when tested in accordance with ASTM C157, 7-day moist cure.

TABLE 2.1-1

Nominal Strength f'c @ 28 days psi Note 1	Type of Concrete	Minimum Cement Lbs. Per CY Note 2	Maximum Water-Cementitious Material Ratio Note 3
Structural Concrete			
6000	normal weight	665	0.40
5000	normal weight	635	0.42
4000	normal weight	540	0.50

Note 1: f'c in accord with ACI 318 Articles 5.3.2 and 5.3.3.

Note 2: Minimum cementitious means total weight of cementitious material as permitted by this Specification (cement, slag, fly ash, and silica fume).

Note 3: Maximum water-cementitious material ratio will be reviewed for conformance to ACI 318 paragraph 5.3.3.2 (f). Field documented mix designs shall be responsive to this requirement.

Note 4: Maximum water content, minimum cement content and maximum allowable slump shall be those reported in the accepted mix design.

Note 5: All concrete exposed to chlorides or sulfates in water, soil, or spray zones, or exposed to deicer chemicals shall have a maximum water-cementitious ratio of 0.40 (minimum f'_c of 5000 psi at 28 days).

All concrete exposed to water shall have a maximum water-cementitious ratio of 0.50 (minimum f'_c of 4000 psi at 28 days) to provide low-permeability.

1. Each mix shall be proportioned to fulfill the water-cementitious material ratio at the maximum permitted slump.
2. Contractor may use fly ash or other pozzolans to replace not more than 30% by weight, pound for pound, of required cement. Contractor may use slag to replace not more than 40% by weight, pound for pound, of required cement. Fly ash or slag may not be used to substitute for cement conforming to ASTM C 595, (i.e., for pozzolan modified cement). Silica fume may be used to replace not more than 10% by weight, pound for pound of required cement. The total amount of fly ash and other pozzolans, slag, and silica fume shall not exceed the limits of ACI 318 Table 4.2.3 for concrete exposed to deicing chemicals.
3. Use admixtures as required by this Specification and as recommended by admixture manufacturer for the specific climatic conditions at the time of placement.
4. Slump of less than 3 inch at point of discharge will not be permitted except where allowed specifically in this Specification.
5. Slab on ground and topping slab concrete shall be macro synthetic fiber reinforced concrete. Minimum dosage shall be 4 lbs/cy unless otherwise noted.

C. Air-Entrainment: Concrete shall be air-entrained in accord with Table 2.1-2 except that entrained air is not required for concrete for footings, interior slabs on ground to receive steel troweled finish, piling or pile caps where such concrete will not be subject to freeze/thaw. Lightweight concrete shall be air-entrained in accordance with Table 2.1-2 except that the entrained air shall be no less than 4% and no greater than 7% to meet U.L. fire resistance rating requirements.

TABLE 2.1-2

TOTAL AIR CONTENT*

Aggregate Size No.**	**Nominal Size**	**Required Air Content (Percent)**
# 467	1-1/2	4.5 ± 1.5
# 57	1	5.0 ± 1.5
# 67	3/4	6.0 ± 1.5
# 7	1/2	7.0 ± 1.5
# 8	3/8	8.0 ± 2.0

* Interior slabs on ground, to receive steel troweled finish, shall have an air content not to exceed 2.0% ± 1%. No air entraining admixture permitted.

** Size designations per ASTM C 33 or C 330.

D. Slump: Concrete shall be proportioned and produced to provide slump, at the point of delivery into the work, as tabulated in Table 2.1-3. A tolerance of not more than 1 inch additional will be allowed for one batch within each five consecutive batches of each mix design.

TABLE 2.1-3

Type of Concrete	**Maximum Slump** inches *
Normal Weight	4
Slab on Ground	4
Pumped	Note 2

* Increased slump may only be achieved by the used of the specified HRWR admixture.

Note 1: All pumped concrete shall contain the specified HRWR admixture. Slump loss shall not be more than 2" from the pump to the point of deposit.

E. Water-Reducing Admixture shall be incorporated into all concrete (not required for mixes designed for superplasticized and self- consolidating concrete) at a minimum dosage of 3.5 fluid ounces per CWT (230 cm^3/100 kg) of cement, in strict conformance with manufacturer's directions. Contractor shall consult with admixture manufacturer and shall propose increased dosage rates as appropriate to achieve optimum workability, cohesiveness and uniformity of concrete mixtures as placed in the Work.

1. Use non-corrosive, accelerating admixture in concrete slabs and in other thin concrete work where concrete is placed at ambient temperatures below 50°F.

F. Superplasticized (HRWR) Concrete: Use in all pumped concrete and concrete with a water/cementitious ratio below 0.50 and in all locations where required to meet the requirements of the Contract Documents. Prepare with a high-range, water-reducing admixture (HRWR). Contractor's mix design shall also include written descriptions of Contractor's methods for mixing, placing and conveying concrete and shall also include design procedures to be used for the formwork.

1. HRWR mixes may be prepared to provide concrete with 9-inch maximum slump and intended slump of 8.0 +/- 1 inch in lieu of the slump maximums specified herein, while adhering to the water-cementitious material ratio maximums specified. Alternatively, HRWR admixture may be used to provide concrete mixtures conforming to the specified maximum slump and water-cementitious material ratio values.
2. HRWR admixtures shall be incorporated into the concrete mixtures at the batch plant or in the field through an approved dispensing unit. Water content of this concrete will be verified on the job site by use of the specified microwave test.

G. Drying Shrinkage Limitations: All concrete placed above grade, except footings and grade beams, and shrinkage compensating concrete shall comply with the following drying shrinkage requirements:
   1. Prior to placement of concrete, a trial batch of mix designs requiring shrinkage control shall be prepared using aggregates, cement and admixtures proposed for each class. From each trial batch, at least 3 specimens for determining the Drying Shrinkage shall be prepared in addition to 6 compression test specimens.
   2. The Drying Shrinkage specimens shall be 4 x 4 x 11 inch prisms, fabricated, moist cured, air dried and measured in the manner provided in ASTM C 157 and as modified herein. Specimens shall be air dried after moist curing for 7 days and shall be measured at an age of 14, 21, 28, and 35 days. The effective gauge length of the specimens shall be 10 inches.
   3. Compression test specimens shall be fabricated, cured and tested in accordance with ASTM C 192. Three specimens shall be tested at an age of 7 days and three at the age of 28 days.
   4. During construction, Drying Shrinkage specimens of each shrinkage class of concrete will be taken to ensure continued compliance with these Specifications. For each shrinkage class of concrete, at least one set of three specimens will be taken from each 1000 cubic yards of concrete placed, but in no case less than three sets of specimens (i.e., nine specimens) will be taken for each class.
   5. The average Drying Shrinkage of the laboratory test specimens after 28 days of drying shall not exceed 0.036 percent. Considering the variations in concrete properties and in testing, a tolerance of 30 percent in the above figure will be accepted for field cast specimens.

H. Water-Cementitious Material Ratio: Calculate water-cementitious material ratio by dividing the weight of total free water (including water found in each admixture) in the concrete, per unit volume, by the number of pounds of cementitious material per unit volume. Total free water shall be taken as the total free water content of the mix when proportioned to produce the maximum allowable slump. Cementitious material is defined as cement, silica fume, fly ash and other natural pozzolans, and blast furnace slag. Water-cementitious material ratio shall be the decimal rounded to two significant figures obtained by dividing the total free water weight per cubic yard (meter) by the total weight of cementitious material per cubic yard (meter).

I. Lightweight Concrete shall be measured in accordance with ASTM C 567, shall provide an air-dry unit weight of not less than 110 pcf (1760 kg/cubic meter) nor more than 115 pcf (1840 kg/cubic meter), and shall have a maximum fresh unit weight of 120 pcf (1922 kg/cubic meter). All measurements shall be taken at points of discharge into the Work. Shrinkage shall not exceed 0.03 percent at 28 days when measured in accord with ASTM C l57.
   1. Lightweight concrete trial mixes shall be tested for splitting tensile strength in accordance with ASTM C 496. Acceptable mixes shall provide a splitting tensile strength of not less than $5.7\sqrt{f'c}$. Splitting tensile strength test results will be used in evaluating the acceptability of proposed mix designs and, except where requested by Architect or by Construction Manager, need not be determined for production concrete.

J. Cement Grout shall be composed of 1 part Portland cement and 3 parts fine aggregate, by volume, with minimum water to produce a stiff, but workable mix.

K. Grout Clean Down shall be composed of one part Portland cement and one and one-half parts of fine sand passing a #30 sieve (600 µm), by volume, with a 50:50 mixture of acrylic or styrene butadiene based bonding admixture and water to produce a grout of the consistency of thick paint.
   1. For unpainted surfaces, determine by testing the amount of white cement needed to color match exposed concrete.

L. Source Changes: Should the source of an ingredient change, for any of the concrete products specified herein, Contractor shall redesign the affected mix and shall resubmit, all prior to incorporating such material into the Work.

M. Test Report Requirements: Contractor's test reports and Testing Agency test reports shall be prepared in a format as given in this Specification.
   1. Mixes shall be designated by a number (Mix No. 1, Mix No. 2,...etc).
   2. Individual samplings of a particular mix shall be designated by a number, with the first sample given the number 100 (Sampling 100, Sampling 101,...etc).
   3. Test cylinder numbers shall be provided using the sample number and a letter (102A, 102B,...etc).
   4. Contractor's Professional Engineer licensed in the project's jurisdiction shall review and shall sign each concrete test cylinder report indicating that the test shows conformance with the requirements of the Contract Documents.

5. Deviations from project requirements shall be identified clearly by circling non-conforming data and by overprinting in 1/2 inch high red letters "NON-CONFORMING."

2.2 CONCRETE INGREDIENTS

A. Cement: Provide an accepted, single source, standard brand Portland cement, conforming to ANSI/ASTM C 150, Type I, II or III or ANSI/ASTM C 595, Type IP. Cement shall be from a single domestic source.
   1. Use Type I or Type II cement except where another cement is herein specified and except where permitted.
   2. For Slabs-on-Ground Concrete, provide ANSI/ASTM C 150, Type II, from a single domestic source.

B. Aggregate: Fine and coarse aggregates shall be regarded as separate ingredients. All aggregates shall meet the requirements listed below except that, where accepted by *Building Code*, non-conforming aggregates will be considered in accordance with the provisions of the Contract Documents.
   1. Coarse Aggregate: shall conform to ANSI/ASTM C 33, and shall consist exclusively of sound and durable gravel or crushed stone, having clean, uncoated, hard and strong particles, free from soft, thin, elongated or laminated particles, and from deleterious materials such as alkali, organic, soft or expansive matter. ASTM Grade Size #67, #57 or #467. Aggregates in excess of 3/4 inch shall not be used except in footings and pile caps, except where required specifically by this Specification or by the Drawings and except where accepted in writing. Water absorption of dry aggregate shall not exceed 1 percent.
   2. Lightweight Coarse Aggregate: shall be a rotary kiln product of expanded shale or slate, conforming to ANSI/ASTM C 330, ASTM Grade Size #67 or ASTM Grade Size #8, and shall conform also to all requirements for Coarse Aggregate.
   3. Fine Aggregate: shall conform to ANSI/ASTM C 33, consisting exclusively of natural sand or crushed stone screenings, having clean, uncoated, hard and strong particles, free from clay, shale, lumps, salt and flaky particles, and from deleterious materials such as alkali, organic, soft or expansive matter. Fine aggregate shall be evenly graded from fine to coarse, with a fineness modulus not less than 2.30, nor more than 3.10.
   4. Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18 % for large top size aggregates (1 ½ in.) or 8%-22% for smaller top size aggregates (1 in. or ¾ in.) retained on each sieve below the top size and above the No. 100.
   5. For concrete exposed to view, provide both coarse and fine aggregates from a single, uniform source.

C. Water: Mixing water for concrete shall be clean, fresh, free from injurious amounts of oil, acid, alkalis, salts, organic materials and other deleterious materials and shall conform to ASTM C 94. Antifreeze agents may not be used unless accepted in writing. In case of uncertainty, water shall be potable.

D. Admixtures listed below by name and by brand are accepted for use in the Work. Other admixtures will be considered for use but are subject to acceptance. Admixtures contributing to chloride, fluoride, sulfide or nitrate ions, or to other substances detrimental to the ingredients of the concrete or to reinforcing steel, will not be permitted in the Work.
   1. Water-Reducing Admixture shall conform to ASTM C 494, Type A.
      a) WR-91, or Eucon MR, by Euclid Chemical Co.
      b) Other accepted admixture.
   2. Air-Entraining Admixture shall conform to ANSI/ASTM C 260.
      a) AEA-92 or Air Mix, by Euclid Chemical Co.
      b) Other accepted admixture.
   3. Prohibited Admixtures: Calcium chloride thiocyanates and admixtures containing more than 0.05% chloride ions are not permitted

E. Chloride Ion: It is understood that certain admixtures do contain a concentration of calcium chloride. Design mix shall contain a summary of total calcium chloride concentration, including the content of admixtures. Total concentration in excess of that listed in ACI 318 Table 4.4.1 will be rejected without further review. Concentrations less than those listed in ACI 318 Table 4.4.1 may be accepted where, in the sole opinion of Construction Manager or of Architect, such concentration will not be detrimental to the Work. The amount of calcium chloride shall be determined by the method described in ASTM C 1218.

F. Fly Ash shall conform to ASTM C 618, Class C or F except that loss on ignition shall not exceed 3 percent and maximum percentage retained on the #325 (45 µm) sieve shall not exceed 20 percent. Fly ash shall be from a single, accepted source.

G. Natural Pozzolans, such as calcined clay, calcined shale, and metakaolin, shall conform to ASTM C618, Class N.

H. Blast Furnace Slag shall conform to ASTM C 989, Grade 120.

I. Fibrous Reinforcement shall conform to ASTM C1116 Type III.

1. Structural Fibers: Structural fibers shall be a patented coarse monofilament, self-fibrillating, polypropylene/polyethylene blend in accordance with ASTM C1116, Paragraph 4.1.3, Type III. Structural fiber shall have a minimum tensile strength of 73 to 80 ksi, minimum length of 2 inches, thickness of 0.015 inches and width of 0.045 inches. Not to replace reinforcement or structural steel.
    a) Tuf-Strand SF, by Euclid Chemical Co.
    b) Other where accepted in writing.
2. Fibrous reinforcement used for secondary reinforcement of concrete slabs shall be fibrillated polypropylene fibers.
    a) Fiberstrand F, by Euclid Chemical Co.
    b) Other where accepted in writing.

2.3 FORMWORK MATERIALS

A. Form Contact Faces:

1. For Surfaces Not Exposed To View:
    a) Lumber shall be stress grade lumber described and used in accord with the National Design Specification for Wood Construction. Lumber shall be dressed on three sides and ends for a tight fit.
    b) Plywood for formwork shall be in accordance with U.S. Product Standard PS-1, Structural 1 "B-B (Concrete Form) Plyform", Exterior Grade, mill oiled and edge-sealed, not less than 9/16 inch thick. Field cut edges shall be resealed with a solvent-based sealant. Each piece shall bear the legible inspection trademark.
    c) Concrete Joist Forms: Joist pans shall conform to standard dimensions given in Code of Standard Practice for Concrete Joist Construction. Pans shall be in clean, like-new condition and shall be steel or fiberglass reinforced plastic. End caps shall be placed at beams, bridging joists and at all special headers.
    d) Waffle Slab Forms: Domes for forming waffle slabs shall be standard molded fiberglass dome forms or standard steel dome forms. Forms shall be in clean, like-new condition.
    e) Chamfer Strips for outside corners in forms may be of wood, metal or PVC at Contractor's option. Rubber chamfer strips may be used only where not exposed to view.
2. Form Gaskets (for sealing form panel joints): Gaskets shall be closed cell, completely skinned, foam rubber or neoprene, with pressure sensitive paperbacked adhesive on surfaces to be bonded to forms. Gaskets shall be of sufficient thickness, widths, and compressibility for specific use.
3. Reveal Formers and Reformers: Sealed (polyurethane) milled fir (dressed and sanded), for straight reveals; and or extruded or molded vinyl, rubber or neoprene of 75 Durometer hardness for special and circular profiles, as required. Reformers shall be reveal strips specified with gasket applied between reveal and concrete.

B. Form Sealers and Release Agents shall be guaranteed by manufacturer to be non-grain raising, non-staining and to not impair the natural bond of paint, waterproofing and other surface coatings.

1. Form Sealer for Lumber Surfaces and Plywood Edges: Polyurethane, clear coating.
2. Sealer for Board Forms: Penetrating sealer, non-grain raising, non-staining, which does not leave a surface coating on the board forms. Accepted Sealer: Clear Pre-Form, by Nox-Crete, Inc., or other accepted sealer.
3. Form Release Agents: Provide chemically reactive, non-staining, non-toxic, commercially blended form release agents that are compatible with material subsequently applied and free from deleterious effects on final concrete surfaces or applied coatings and finishes. Products containing castor oil shall not be used in the Work.
    a) General Purpose Form Release Agents

i) Formshield Pure, by Euclid Chemical Co.
ii) Other where accepted.

C. Form Ties:
1. For Surfaces Not Exposed to View: Ties shall be of standard manufacture, factory fabricated, designed specifically for use in concrete formwork. Non-fabricated wire and similar accessories shall not be used. Sizes shall be appropriate for the wall, beam, or other element formed. Ties shall be readily removable leaving no metal within 1 inch measured from the concrete surface and shall be free of lugs, cones, washers, or other devices that will leave a hole larger than 1 inch. Use Williams Form Engineering Corp. or Dayton Superior coil ties, with cones or accepted snap ties with cones, except where ties of another design or manufacture are accepted.
2. Typical formwork for columns and for shallow, i.e. 30 inch, spandrel beams shall be designed so that ties are not required.

D. Other: Formwork materials not given herein or identified in Drawings shall be subject to acceptance.

2.4 REINFORCEMENT MATERIALS

A. Reinforcing Bars, Column Ties, etc.: Except where more stringent requirements are given in the Drawings or required by *Building Code*, provide ASTM A 615, new billet steel, deformed. Rail, axle, or rerolled steel shall not be used.
1. Provide Grade 60 unless otherwise given in the Drawings or in this Specification.
2. Where welding to structural steel, provide ASTM A 706, Grade 60.
3. Steel wire shall conform to ASTM A 82, plain, cold-drawn steel.

B. Welded Steel Wire Fabric: ANSI/ASTM A 497 (deformed wire) for sizes D4.0 and larger and A 185 (plain wire) for sizes less than W4.0, produced by a domestic manufacturer, with a minimum tensile strength not less than 70,000 psi. Provide, deliver and store as flat sheets only; rolls will not be permitted.

C. Epoxy-Coated Reinforcement and their Supports shall be subject to all applicable portions of this Specification and, in addition, shall be subject to the following:
1. Epoxy-coated reinforcement shall conform to ASTM A 775 and to ASTM A 615 or A 706 as appropriate; welded wire fabric shall conform to ASTM A 884, Class A and to ASTM A 497 or A 185.
2. Acceptable manufacturer shall be in possession of current CRSI coating plant certification.
3. Bar and mesh supports shall be manufactured from a dialectric material or shall be wire bar supports coated with a dialectric material such as epoxy or vinyl, compatible both with the concrete and with the epoxy coating. Coating of wire bar supports shall cover the entire bar support. Metal may not extend closer than 5/8 inch to the concrete surface and color of coating shall match that of the finished concrete.
4. Tie wire shall be nylon coated.
5. Proprietary combination bar clips and spreaders used in walls shall be non-corrosive, compatible both with the coating and with the concrete.

D. Deformed Bar Anchors shall be ASTM A 496 deformed bars prepared for stud welding in accordance with AWS D1.1. Material shall conform to AWS D1.1, Chapter 7, Type C. Accepted manufacturer is the Nelson Stud Welding Division of TRW or other accepted manufacturer. Provide 1/2 inch diameter, 36 inch long bars, unless otherwise given in drawings.

E. Tie Wire: 18 gauge or heavier, black annealed wire, conforming to ANSI/ASTM A 82. Tie wire in concrete at exposed surfaces shall be non-corrosive; stainless steel, monel, or plastic coated.

F. Bolsters, Chairs, Spacers, and other devices for spacing supporting and fastening reinforcing bars and welded wire fabric:
1. Accessories shall be all-plastic or shall be plastic coated metal. Metal may not extend closer than 1/8 inch to concrete surface. Plastic color shall match finished concrete color. Conform to CRSI requirements.
2. For concrete surfaces exposed to view, bar supports shall be CRSI, Class 1 (plastic protected) or CRSI, Class 2 (stainless steel protected). Acceptable manufacturers are Dayton Superior, or other accepted manufacturer.

3. Precast concrete blocks furnished for reinforcement support shall be produced specifically for intended purpose; brick, stone, wood and other materials will not be permitted. Precast concrete blocks three inches or larger shall have the same compressive strength as the structural concrete in which they are used. Precast blocks smaller than three inches shall be 6,000 psi at time of use.
4. For slabs-on-ground, use supports with base plates or with horizontal runners at all locations where base materials will not properly support the legs of chairs.
5. Mesh reinforcing for slabs on metal deck may be pulled up, in place, as the casting of concrete progresses. Mesh supports, where required, shall be by Dayton Superior, or other accepted manufacturer.

G. Beam and Column Caging Clips shall be not less than 12 gauge, galvanized, of the adjustable type to maintain the wire 1 inch clear of the steel. Hohmann & Barnard, or other accepted clip.

2.5 MISCELLANEOUS MATERIALS

A. Non-Shrink Grout shall be natural aggregate grout pre-mixed and bagged by manufacturer. Non-shrink grout shall conform to ASTM C 1107 Grade B or C when tested at a fluid consistency of less than 30 seconds per ASTM C 939 at temperature extremes of 40°F and 90°F (7°C and 32°C) and an extended working time of 30 minutes. The corresponding minimum compressive strength of the grout at 28 days, based on ASTM C 942, shall be 7500 psi. The grout shall exhibit no measurable bleed when tested in accordance with ASTM C 940.
   1. Hi-Flow Grout, by Euclid Chemical Co.
   2. Other where accepted.

B. Epoxy Grout shall be non-shrink, 100% solids, 3-component, moisture tolerant grout.
   1. E3-F, by Euclid Chemical Co.
   2. Other where accepted.

C. Bonding Admixture shall be Latex type, non-redispersable, modified sand cement mortar conforming to ASTM C 1059, Type II.
   1. Flex-Con or SBR Latex, by Euclid Chemical Co.
   2. Other where accepted.

D. Epoxy Adhesive shall conform to ASTM C 881, and shall be a two-component, 100% solids material, suitable for use on both dry and wet surfaces. Acceptable materials:
   1. Euco #452, by Euclid Chemical Co.
   2. Other where accepted.

E. Polymer Repair Mortar: These patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Structural Engineer is required.
   1. Thin Top Supreme or Concrete Top Supreme (horizontal repairs), Verticoat or Verticoat Supreme (vertical and overhead repair),by Euclid Chemical Co.
   2. Other where accepted.

F. High Strength Flowing Repair Mortar for forming and pouring structural members, or large horizontal repairs, provide the flowable one-part, high strength microsilica modified repair mortar with 3/8" aggregate. The product shall achieve 9000 psi @ 28-days at a 9-inch slump.
   1. Eurococrete, or Euco Speed MP (Cold Weather) by Euclid Chemical Co.
   2. Other where accepted.

G. Fusion Bonded Epoxy Coating shall conform to ASTM A 775. Acceptable manufacturer is ScotchKote 413 by 3M, or other where accepted.

H. Patching Material for Epoxy Coated Reinforcement shall be ScotchKote 413/215 PC Patch Compound by 3M or other accepted patch material.

I. Drill-In Anchors shall be wedge-type. Capsule-type will not be permitted. Drill-in anchors shall be standard wedge-type unless otherwise noted. Drill-in anchors designated in the Drawings as carrying a direct tensile load shall be undercut wedge-type.
   1. Standard Wedge-Type Anchors
      a) Kwik Bolt TZ-2, by Hilti Corp.
      b) Power-Stud, by Powers Fasteners Inc.
      c) Other where accepted
   2. Galvanizing shall conform to ASTM B 695, Class 50 or to ASTM B 633, SC1.

3. Stainless steel for studs and washers shall conform to AISI Grade 304 or Grade 316 and to ASTM F 593, Group 1 or Group 2, Condition SH. Nuts shall be of stainless steel conforming to ASTM F 594, Group 1 or Group 2, Condition SH.

J. Self-Drilling Fasteners for Stay-In-Place Formwork shall be #12 - 14 x 3/4" HWH TEKS/1 as manufactured by Buildex Division of Illinois Tool Works, or other accepted self-drilling fastener.

K. Expansion Dowels shall be ASTM A 36 bars or equivalent, hot-dip galvanized, of the diameter and length given in the Drawings, and shall be provided with a suitable expansion shield securely positioned and end filled by readily compressible material assuring adequate expansion space beyond the free end of the dowel.

1. Acceptable Expansion Dowels: Dowel Bars by American Highway Technology of Dayton Superior. Acceptable expansion shields: Metal Dowel Caps by American Highway Technology of Dayton Superior, or other accepted dowel.

L. Dovetail Slots: 20 gauge or thicker, hot-dipped galvanized steel, with removable filler, 5/8" face x 1" deep x 1" back. Dovetail slots as well as dovetail anchors which engage such slots shall be obtained from a single source. Slots and anchors shall engage with a positive snug fit. Acceptable Dovetail Slots: DA 100, by Dur-O-Wall Inc.; No. 305 by Hohmann and Barnard, or other accepted slot.

M. Light Duty Hanger Inserts: Unless otherwise given in the Drawings, miscellaneous light duty hanger inserts shall be hot-dip galvanized, and shall be Gateway standard insert, malleable, Type C, to accept 3/8 inch diameter bolt, as manufactured by Dayton/Richmond, Copper B-Line., HCI-WF/MD by Hilti, or other accepted insert. The maximum load to be supported by such inserts shall be limited to 100 pounds.

N. Shelf Angle Wedge Inserts: Unless otherwise given in the Drawings, wedge inserts shall be hot-dip galvanized, malleable iron, sized to accept a 3/4" diameter bolt. Acceptable wedge inserts: 425-6 by Heckmann Building Products Inc., HW-340 by Hohmann and Barnard, F_7-L by Dayton Superior, or other accepted manufacturer.

O. Flashing Reglets: Where resilient or elastomeric sheet flashing of bituminous membranes are terminated in reglets, provide 28 gauge (380 μm) minimum thickness stainless steel reglets of type designated in the Drawings, or Type A PVC reglet; fill with butyl rubber sealer so as to make all joints watertight. Temporarily fill reglet or cover face opening to prevent intrusion of concrete or debris.

P. Waterstops shall be extruded from a virgin poly vinyl-chloride compound meeting all of the requirements set forth in the U.S. Army Corps of Engineers Specification CRD-C-572. Select waterstop based on concrete profile, anticipated joint movement, maximum possible water pressure and placement. Only where the requirements of CRD-C-572 are met, provide the following:

1. Construction Joints: Provide 6" wide dumbbell type or ribbed type.
   a) Type DB-5 or 11B, by DuraJoint Concrete Accessories.
   b) Style 746 or 782, by Greenstreak.
   c) Other where accepted.
2. Hydrophilic waterstop shall consist of 75% sodium bentonite and 25% butyl rubber compound formed into uniform coils. Waterstop to be installed per manufacturer's guidelines using a non-flammable, latex and water based adhesive used to secure hydrophilic waterstops. Locations need be submitted for approval to Structural Engineer and Architect.
   a) Waterstop-RX, by Colloid Environmental Technologies Company.
   b) Swellstop, by Greenstreak.
   c) Expand Tite, by DuraJoint Concrete Accessories.
   d) Other where accepted.

Q. Polyurethane Sealant shall be Eucolastic I by Euclid Chemical Co., Dymonic by Tremco, Inc., Sikaflex-1a by Sika Corp., or other accepted sealant. Sealant shall conform to ASTM C920. Color shall be accepted by Architect. Backer rod shall be as recommended by sealant manufacturer.

R. Joint Filler: Use non-staining, non-extruding, compressible and resilient joint filler of sponge rubber conforming to ASTM D 1752, Type I. Joint fillers which contain or have been treated with oil, grease or bituminous materials are prohibited. Test joint fillers for compatibility with proposed primers and sealants as specified in Section 07 90 00.

1. Acceptable joint filler: FF-3 Sponge Rubber, by Progress Unlimited, Inc.; Cementone Sponge Rubber, by Tamms Industries; or other accepted filler.
2. Joint Sealing Compound: See Section 07 92 00 of this Specification.

S. Compressible Filler where required under slab on grade: 2 or more layers of geotextile material to provide a minimum 1" thickness after concrete slab is in place. Accepted material: CCW-Miradrain 6000/6200, by Carlisle-CCW Inc. or other accepted material.

T. Bond Breaker shall be 4 mil (100 µm) thick polyethylene sheet.

U. Curing Paper: Sheet material conforming to ASTM C 171, Type 1, regular, non-bleeding and non-staining. Acceptable curing paper: Glass Craft, by Firstline Corporation; Orange Label Sisalkraft, by Fortifiber Corp.; or other accepted curing paper.

V. Vapor Barrier for slab-on-ground shall conform to ASTM E1745, Class A or B. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Lap sealant shall be the manufacturer's recommended bonding material.
   1. Zero Perm by Alumiseal.
   2. Moistop Ultra (15 mil) by Fortifiber Corp.
   3. Stego Wrap (15 mil) Vapor Barrier by Stego Industries LLC.
   4. Premolded Membrane Vapor Seal with Plasmatic Core, by W.R. Meadows, Inc.
   5. Other accepted barrier.

W. Crushed Stone:
   1. Under slabs-on-ground shall consist of clean, hard, durable, natural rock, free of organic matter, rock dust and other contaminants, and shall be well graded within the requirements of ASTM C 33, Size #467.
   2. Bridging rock where required to span over softer areas of the underlying soils shall consist of a coarse granular mixture of rock fragments having a maximum particle size of 6 inches. It is anticipated that quarry run or crusher run materials will be satisfactory. The material shall be well graded between the maximum and minimum sizes with no more than l5 percent passing the U.S. Standard Number 200 sieve.

X. Compactible Fill under slabs-on-ground shall be composed of well graded gravel or crushed stone, 1½" maximum size. "Crusher run" material is satisfactory. Do not use sand except with prior approval of the Architect. Fill shall be free-draining, free from clay, shale, lumps, salt, organic matter, rock dust and other contaminants, and shall consist of hard, clean and durable particles.

Y. Composite Drain Material shall be In-Drain by Eljen Corp., CCW-Miradrain 6000/6200, by Carlisle-CCW Inc. or other accepted material. Insulating Composite Drain Material shall be Insulated Drainage Panel, by Geotech Systems Corp., or other accepted material, and shall contain both the filter fabric and the in-plane drainage core.

Z. Geotextile Filter Fabric shall be Mirafi 500X by Mirafi Construction Products, or other accepted fabric.

AA. Masonite Hardboard: Provide 1/8 inch thick R-3105-2 Masonite.

AB. Spark Tester for testing waterstop splices: Use Spark-Tester by JP Specialties Inc. or other accepted manufacturer.

2.6 SURFACE TREATMENTS

A. Clear Curing and Sealing Compound VOC Compliant, 350 g/l, shall be a liquid type membrane-forming curing compound, complying with ASTM C 1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 kg/m2 when applied at 300 sq. ft./gal. Compound shall be compatible with all subsequent finishes and toppings, shall chemically combine fully with the concrete in 30 days or less, shall leave no surface residue, and shall preclude secondary reactions within concrete as well as materials applied to the concrete surface. Manufacturer's certification is required. Subject to project requirements, provide one of the following products:
   1. Super Diamond Clear VOX, by Euclid Chemical Co.
   2. Other where accepted.

B. Dissipating/Non-residue Forming (Strippable) Curing Compound (VOC Compliant, 350 g/l) shall be a liquid membrane-forming compound conforming to ASTM C 309, Type 1 or 1-D that chemically breaks down and wears off after curing is complete. Install in strict accordance with the manufacturer's recommendations. Manufacturer's certification is required.
   1. Kurez DR VOX, by Euclid Chemical Co.
   2. Other where accepted.

C. Evaporation Retarder/Finishing Aid:
   1. Eucobar, by Euclid Chemical Co.
   2. Other where accepted.

D. Surface Retarder:
   1. Concrete Surface Retarders, by Euclid Chemical Co.
   2. Other where accepted.

E. Liquid Densifier/Sealer: The liquid densifier compound shall be a siliconate based sealer which penetrates concrete surfaces, increases abrasion resistance and provides a “low-sheen” surface that is easy to clean and eases the problem of tire mark removal.
   1. Euco Diamond Hard, by Euclid Chemical Co.
   2. Seal Hard, by L & M Construction Chemicals, Inc.

F. Non-Oxidizing Metallic Hardener: The specified non-oxidizing metallic floor hardener shall be formulated, processed and packaged under stringent quality control at the manufacturer’s owned and controlled factory. The hardener shall be a mixture of specially processed non-rusting aggregate, selected Portland cement and necessary plasticizing agents. Product shall be “Diamond-Plate” by Euclid Chemical Co. or other were accepted.

G. Waterproofing and Chloride Ion Screen: Silane water repellent and chloride ion shield shall contain not less than 40 percent solids and shall provide not less than 90 percent chloride ion screening capability when tested in accordance with NCHRP 244.
   1. Euco-Guard VOX, by Euclid Chemical Co.
   2. Other where accepted.

H. Abrasive Aggregate for Stair Treads and Non-Slip Surfaces shall contain not less than 95 percent aluminum oxide, #8 to #30 screen size. Accepted abrasive aggregate shall be A-H Alox by Anti-Hydro International, Inc., Emery Non-Slip by Dayton Superior, Grip It AO by L & M Construction Chemicals, or other accepted aggregate.

J. Concrete Cleaning/Finishing Solution: General surface cleaner shall be a commercial concrete cleaner containing solvents, stain removers, detergents and a maximum of 2 percent chloride acid. Accepted cleaner: Light Duty Concrete Cleaner by ProSoCo, Inc., or other accepted compound.

PART 3 EXECUTION

3.1 CONTRACTOR'S INSPECTION

A. Examination of Field Conditions: Examine all surfaces, features and facilities to which Work must be attached or applied, abut or clear. Notify Construction Manager and Architect in writing of all conditions which are or will be detrimental to proper and expeditious installation of Work. Starting of Work shall represent acceptance by Contractor of surfaces and of conditions as suitable and correct for performing Work as specified.

B. Field Measurements: Contractor shall verify, by measurements at the job site, all dimensions affecting the Work of this Section. Field dimensions at variance with those in accepted Shop Drawings shall be reported in writing by Contractor. Decisions regarding corrective measures shall be subject to acceptance and acceptance shall be obtained before starting fabrication of items affected. The starting of Work shall represent acceptance by Contractor of all dimensions affecting the Work of this Section as suitable and correct for the performing of all Work under this Section.

3.2 FORMWORK

A. Reference Standards: Formwork shall conform to ACI 347R, except where more stringent requirements are given in the Drawings or in this Specification.

B. General: Contractor shall be solely responsible for the design, engineering, construction, completeness, safety and adequacy of all concrete formwork. Provide removable formwork for all concrete not indicated specifically to be formed by other means. Provide for anchorages and inserts, blocking, bulkheads, chamfers, keys and keyways, ledges, moldings, offsets, openings, recesses, reglets, screeds and all else to complete the Work.

1. Formwork shall be designed and constructed to withstand all forces imposed upon the formwork including all construction dead and live loads, horizontal loads from equipment, wind and earthquake forces, and forces due to vibration of plastic concrete. Shoring shall be adequate in strength and in position so that loads of successive parts of the structure will be transmitted directly through the falsework without the creation of shearing or bending stresses in the concrete Work. Shoring shall not bear on slabs on ground until such concrete has attained design strength and only where the slab-on-ground is able to accept the imposed loads without distress.
2. Formwork shall be tight to prevent leakage of mortar from the concrete so as to provide concrete free of honeycombs, shall be of adequate rigidity and strength, and shall be adequately braced to produce true lines, free of bulges and unsightly depressions, to accurate elevations and correct alignments. Joints between form face edges shall be tight and strongly backed to provide joints that are flush and true. Provide inspection of all formwork for conformance with this Specification and with form drawing design, both prior to, during and after concreting.
3. Fabricate for easy removal, without prying or hammering against concrete surfaces. Provide crush or working plates where stripping may damage concrete surfaces.
4. Provide top forms at all inclined surfaces where slope is too steep to place concrete with bottom form only.

C. Construction and Erection of Forms:

1. To maintain specified tolerances, camber forms and shores for beams and slabs to compensate for anticipated deflections in the formwork prior to hardening of the concrete; provide additional camber where noted in the Drawings. Camber top surface and set screeds to maintain uniform thickness. Where Drawings do not show specific camber, provide a minimum camber equal to 1/4" for each 15 feet of span (for flying beams, not supporting slabs or other beams, provide 1/8" for each 15 feet of span); for cantilever spans, camber 1 inch for each 8 feet of cantilever. Camber shall be parabolic, tapering from center of span to each support. Set screeds to follow camber so as to maintain a uniform thickness of concrete.
2. Build into formwork positive means of adjustment (wedges, jacks and the like) of shores and struts and take out all settlements during concrete placement operations. Brace forms securely against lateral forces and to prevent lateral deflections.
3. Build into the formwork and otherwise make necessary provisions in formwork to accommodate the Work of other Sections of this Specification. Obtain required information and materials from affected trades. Install inserts, sleeves, edge and corner angles, steel frames and the like securely in the formwork to allow sound embedment of their anchorage devices, without displacement, and to provide the required alignment to the formed and finished concrete faces and surfaces. Provide boxouts for items to be provided at a later date. Seal, or fill with readily removable filler all voids in embedded items and sleeves in order to prevent complete or partial filling by intrusion of concrete paste.
4. Provide material with sufficient thickness so that newly placed concrete does not bow, distort or deflect formwork.
5. Concrete Surfaces Exposed to View: Form tie spacing and rigidity of formwork shall be sufficient to provide continuous, straight, smooth and true surfaces and edges, visually acceptable. Unsightly joint marks will not be permitted.
    a) Plywood panels shall be laid out as shown in the Drawings. Where not shown, use full sheets in vertical position with splice seams at the same level, (except at surface ends).
    b) Joints shall be reinforced so that edges remain flush and true.
    c) Chamfer exposed corners and edges, whether or not shown in Drawings, to provide tight edge joints and smooth and even lines.
    d) Design forms, studs and walers to limit deflection between supports and stiffening members to a maximum of 1/360th of the span.
6. Concrete Surfaces Not Exposed to View: Contractor may use plywood, lumber, metal and other materials included under this Specification.

7. Reuse of Form Material: Clean thoroughly and repair forming materials prior to reuse. Damaged material which cannot be properly reconditioned to produce Work conforming to this Specification shall be discarded. Formwork may be reused only the number of times which will assure that concrete surfaces produced will meet the provisions of this Specification. Condition of formwork and use or reuse of formwork shall be subject to acceptance. Formwork for architectural concrete which cannot be tightly butted and made mortar-tight shall not be reused. Where reuse of forms is permitted or accepted, withdraw all nails, clean forms, and repair damaged surfaces by replacement of damaged boards or units. Formwork materials rejected shall be removed promptly from the site.
8. Clean-Out and Access Panels: Provide readily removable and securely replaceable panels in column forms, wall forms, and other types of formwork as needed to permit ready access for cleaning formwork totally free from standing water, dust, dirt and other debris, allow inspection of condition of formwork, reinforcement, and concrete bonding surfaces, and as needed to allow proper access for concrete placement and vibration. Locate removable panels to minimize exposure to view, except where more exposed locations are accepted.
9. Protect Soft Materials such as Styrofoam from contact by vibrators and other equipment. Evidence of dispersion of such materials into concrete will be considered as evidence for rejection of that concrete.

D. Form Release Treatment: Clean and treat all removable forms with form release agent prior to placing reinforcement and embedded items. Remove excess form release agent and do not allow agent to come in contact with previously placed concrete or reinforcing steel.

E. Clean and Tighten all forms immediately prior to casting concrete. Retighten formwork after placing concrete to account for concrete shrinkage and the like and to minimize mortar leakage.

F. Concrete Encased Steelwork: Take special care to assure that formwork for concrete encasing of structural steel members is organized and installed to permit accurate location and proper clearance for reinforcing steel, and proper access for placing and vibrating concrete.

G. Horizontal and Sloped Concrete Surfaces below finish grade which will not be exposed to view, where permitted and where shown in Drawings, may be formed by the use of clean cut trenches in lieu of forms.
1. Provide 3 inches minimum cover to reinforcement at all surfaces formed by earth, rock, or geotextile fabric.
2. Provide vapor barrier liner at all surfaces composed of uncemented granular materials, geotextile fabric and other materials which readily absorb water.

H. Mud Slabs shall be a minimum of 3" thick and shall be provided at all locations where shown in the Drawings and at other locations where needed to protect adequately the bearing surface.

3.3 FABRICATION AND PLACEMENT OF REINFORCEMENT

A. Reinforcing Steel Shall be Shop Fabricated in strict accord with the Shop Drawings, certificates, and other submitted and accepted data. All Work shall conform to the applicable Standards as given herein and as need apply to the Work. Workmanship shall be of the best practice of relevant trades and shall be performed by skilled mechanics making use of modern tools and equipment which are in good condition. To the extent practical, Work shall be accomplished in the shop and not in the field.

B. Reinforcing Steel, whether existing or provided under this contract, shall be free from paint, oil, dirt, scale, ice, frost, loose rust, grease, clay or other soil, and other substances or coatings which could reduce bond with concrete.

C. Placing Reinforcing Steel: Comply with the more severe of ACI, CRSI, *Building Code* and this Specification.

D. Reinforcing Bar Supports shall be appropriate to the intended use, of sufficient number, spacing, rigidity and strength to prevent displacement of reinforcing and to hold reinforcing accurately in correct position both before and during concrete placement. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar supports. Do not use bar supports as support for runways, conveying equipment or for any purpose other than for supporting reinforcing bars.
1. For concrete surfaces not exposed to view, use plastic or hot-dip galvanized supports.
2. For concrete surfaces exposed to view, use plastic or plastic-tipped supports. Where in contact with formwork for Architectural Concrete, lay out in line with formwork joints.
3. For slab on ground, use chairs with base plates.

4. Securely tie and support reinforcement to prevent displacement by construction traffic and casting of concrete. Neither top nor bottom bars shall be allowed to sag below tolerances specified by Building Code or required by the Contract Documents. Concrete cover shall be uniformly maintained. Displacement of reinforcing steel and embedded items shall be corrected immediately and additional supports provided to prevent recurrence. Conform explicitly to Article 7.6, ACI 318. Separate adjacent layers of parallel bars with short lengths of #8 rebars placed transverse to and securely tied to separated bars of #8 or smaller size; separator bars for #8 and larger bars shall be of the largest bar size separated.

E. Over Metal Deck, reinforcing steel shall be tied securely and supported prior to placing concrete. WWF placed over metal deck shall be tied securely and may be pulled up to proper position as the casting of concrete progresses.

F. Tie Wires, where applicable, shall be tied to and bent behind bars in such a manner that concrete placement will not force the wire ends toward the exposed concrete surfaces. At exposed concrete surfaces, tie wire ends shall not fall within required clear concrete cover.

G. Wire Mesh: Lap deformed wire mesh reinforcement at all edges such that the overlap measured between the ends of each fabric sheet is not less than the larger of 8 inches, the spacing of the cross wires plus 2 inches and 1.3 times the development length of the deformed wire, unless a larger lap is noted in the Drawings. Unless a larger lap is noted in the Drawings, lap plain wire mesh reinforcement at all edges such that the overlap measured between the outermost cross wires of each fabric sheet is not less than the larger of 6 inches, the spacing of the cross wires plus 2 inches, and 1.5 times the development length of plain wire. Provide and install in sheet lengths as long as is practical. Wire together adjacent sheets of mesh. Offset end laps not less than the width of the fabric sheet, precluding continuous end laps.

H. Tack Welding of reinforcing steel bars or mesh is prohibited. Reinforcement damaged by arc strikes or arc welding shall be replaced. Welding of reinforcing bar intersections is prohibited.

I. Welding and Flame Heating of reinforcing steel is prohibited unless performed in accord with appropriate qualified procedures and detail sketches prepared by Contractor and both submitted and accepted. Acceptance will be contingent on the following:
   1. Use bars with proper metallurgy.
   2. Follow explicitly AWS D1.4, including the qualifying of welders and welding procedures, prior to commencement of work.
   3. Monitor preheat with Tempilstiks.
   4. Provide proper protection to adjacent bars and concrete.
   5. Each weld need be completed in a continuous operation, without stopping.
   6. Cool slowly with insulating blankets.
   7. Do not start welding on a bar until adjacent welds have cooled.
   8. Remove damaged concrete on completion of all welds.
   9. Properly bond, place and cure patch.

J. Coordination Detailing and Erection: Reinforcement shall be coordinated, detailed and erected to provide a clear passage for the positioning of tremie trunks in required locations. These openings shall be free of bars, bar ends, wire, ties, or obstructions which could hamper insertion and removal of the trunk.

K. Minimum Size WWF: Provide 6x6-W2xW2 WWF minimum in all concrete fill slabs except where heavier reinforcement is shown explicitly in the Drawings and except for filling of metal pan treads and intermediate platforms which may be 2" x 2", 14 gauge, galvanized.

L. Reinforcing Bar Mechanical Connections shall be installed in accordance with ACI 439.3R and manufacturer's printed instructions.

M. Epoxy-Coated Reinforcement shall be subject to all applicable provisions of this Specification and, in addition, shall be subject to the following provisions:
   1. Cold bend all bars around pins with nylon collars and take other steps required to minimize damage of the coating during fabrication. Hot bending will not be permitted.
   2. Handling and hoisting shall be done with care, making use of nylon lifting slings. Bundles of reinforcement shall be lifted in a manner to prevent abrasions; spreaders shall be used to lift bundles where lifting at third points is not practical. Bundling bands shall be padded or shall be nylon.
   3. Store epoxy-coated reinforcement on padded or wooden cribbing.
   4. Reinforcing bars used as support bars for epoxy-coated reinforcement shall be epoxy-coated.

5. Field bending and field cutting of epoxy-coated reinforcement will not be permitted except where authorized expressly in writing.
6. Epoxy-coated reinforcement shall be saw cut; flame cutting is prohibited.
7. Damage to coating on bars exceeding 0.3 inches in any direction shall be repaired in accord with the patching material manufacturer's published instructions. Bars requiring patching in excess of 2 percent of the surface area of that bar shall be rejected and shall be removed immediately from the site.
8. All damage (i.e., 100%) to coating on weld wire fabric shall be repaired in accord with the patching material manufacturer's published instructions. Welded wire fabric requiring patching in excess of 1 percent of the surface area per linear foot of each wire shall be rejected and shall be removed immediately from the site.
9. Splicing of epoxy-coated bars shall be by lap-splice or by accepted mechanical couplers.

N. Concrete Anchors and Deformed Bar Anchors shall be installed in strict accord with the provisions of Section 05 30 00.
1. Where indicated in the Drawings, bend concrete anchors and deformed bar anchors in accordance with the requirements of the Drawings and of this Specification:
a) Before automatic stud welding, cold bend concrete anchors and deformed bar anchors as required in accordance with the bend requirements given in the Contract Documents for concrete reinforcing bars of the same diameter. The use of heat to either bend or straighten concrete anchors is not permitted.
b) Once bent, the shop straightening of either concrete anchors or deformed bar anchors is not permitted. The field straightening of bars that have been embedded in concrete is not permitted except where accepted specifically.

O. After-Set Inserts: At wall surfaces to receive after-set inserts, with written acceptance, it may be possible to place reinforcing steel to clear the depth of the field penetration. Whether or not permission is obtained, Contractor shall not cut or damage reinforcing steel in setting of after-set inserts or for any other reason.

P. Lap Splices: Reinforcing bars may be lapped in contact splices wired together or by lap lengths separated by spacing shown or noted in the Shop Drawings or permitted by this Specification.

Q. Straightening: Once bent, the shop straightening of reinforcing bars is not permitted. The field straightening of bars that have been embedded in concrete is permitted only where authorized specifically.
1. For field bending, acceptance will require generally that larger bars be heated to 1200°F (700°C) maximum and that concrete be protected by insulation blankets. After straightening, acceptance will require that bars be insulated and cooled slowly.

3.4 JOINTS

A. Construction Joints:
1. Construction joints shall be made and located so as to least impair the strength and appearance of the structure. Construction joints shall be made only at locations shown in the Contract Drawings or accepted specifically. Construction joints shall conform to the *Building Code* and to ACI 318, Article 6.4. Location of all construction joints not shown in the Drawings shall be submitted for acceptance.
a) All construction joints shall be keyed not less than 1-1/2 inches deep. Wood box-outs treated with a form release agent or cellular polystyrene box-outs shall be used for keying concrete; the chipping of keys after concrete placement as a construction methodology is prohibited. Continue all reinforcing steel across construction joints. Contractor shall supply, fabricate, and place additional reinforcing steel where location of construction joint in any way weakens the construction.
b) Horizontal construction joints will not be permitted in beams and slabs except where shown in the Drawings. Horizontal construction joints in walls will not be permitted except where shown in the Drawings or in accepted Shop Drawings.
c) Where terrazzo, pavers, stone or other overlay finishes are required, locate slab construction joints accurately at locations directly below expansion joints in the overlay material. Waiver of this requirement will not be given except that, for sand-bedded finishes, alternative proposals will be considered.

2. Spacing of Construction Joints: Conform to and do not exceed maximum distance between construction joints as shown or noted in the Drawings and in this Specification. Where no other restriction applies, provide construction joints at a spacing not greater than 33 feet (10 m) joint-to-joint in perimeter walls below grade; 65 feet (20 m) maximum joint-to-joint in perimeter walls above grade and all interior walls, above or below grade; 90 feet (27 m) maximum joint-to-joint and providing 6,000 square feet (560 square meters) maximum for slab pours; 26 feet (8 m) maximum joint-to-joint in runway slabs for window washing equipment, 20 feet (6 m) for sidewalks (in line with curb joints). In considering wall joints, a 90 degree corner may be considered a joint. Limitations on construction joint spacing do not apply to slabs on steel deck.
3. Special Roughened Construction Joints (SRCJ): For construction joints noted in the Drawings, in addition to keying, the hardened concrete joint face shall be cleaned totally free from laitance either by applying a spray-on surface retarder to the fresh concrete and water blasting or by bush hammering. Provide a rough, sound surface with a roughness amplitude not less than 1/4 inch between projecting aggregate faces and recessed sand-cement matrix. Other construction joint roughening means and procedures are subject to acceptance.
4. Column and Wall Joints: Cast columns and walls to an elevation ½ inch + 1/4 inch higher than the lowest abutting girder, beam or slab.

B. Construction Joints Not Located in Drawings:
1. For Cast-In-Situ Beam and Slab Construction: Where construction joints are not located in Drawings, submit proposed locations for acceptance. In general, in areas not specifically shown in Drawings, construction joints shall be located as follows:
   a) Slabs, Beams and Girders: Within the middle third of a span, unless a beam intersects a girder at this point, in which case the joints in girders shall be offset a distance equal to twice the width of the beam.
   b) Locate construction joints perpendicular to the main reinforcement.
2. For Slabs on Metal Deck Construction: Locate construction joints parallel to beams and girders, not closer than 6 inches to stud shear connectors.
   a) Where parallel to supporting beams, locate not more than 1'-8" from the centerline of a supporting beam such that most of the slab span containing the construction joint contains concrete from the first pour.
   b) Where perpendicular to supporting beams, locate not more than 3'-4" from the face of the supporting girder such that most of the supporting beam is not concreted in the first pour.

C. Expansion Joints: Locate and construct as shown or noted in the Drawings. Do not continue reinforcement or conduit through expansion joints. Working width of expansion joints shall be kept free from all extraneous materials. Contractor shall take special care to assure that expansion joints are properly constructed, cleaned, and function properly. Joints shall be cleaned prior to removal of soffit formwork and shall be recleaned just prior to installing finish materials. Take particular care to remove wood, cellular polystyrene and other soft materials from such joints.

D. Control Joints in Walls: Locate and construct as shown or noted in the Drawings and as given in accepted Shop Drawings. Install crack inducer in accurate alignment with form joint and attach securely to reinforcing steel as required to maintain alignment and cover during placement of concrete. Install at exterior and interior face of wall. Where indicated, caulk joints after removing forms using accepted polyurethane sealant and backer rod.
1. Interrupt one-half of the horizontal temperature reinforcing steel at joint line.
2. Unless otherwise shown, provide at not more than 16’-0” o.c., located at vertical form joint lines.
3. For purposes of maximum spacing, both construction joints and 45° or larger wall bends may be considered as control joints. Do not provide crack inducer and do not interrupt reinforcing steel at construction joints or at wall bends.
4. Do not provide control joints in walls subject to hydrostatic pressure or in perimeter walls below grade except where accepted by Architect.
5. Proposals by Contractor to use control joints in locations other than those indicated shall include a full description of both the materials (including waterstops where required) and the procedures to be used in the Work.

E. Control Joints in Slabs on Ground: Do not provide for slabs subjected to hydrostatic pressure. Locate and construct as shown or noted in the Drawings and as given in Shop Drawings.

1. Unless otherwise shown, provide at no more than 36 times slab thickness, located neatly along column lines, and interrupt one-half of the temperature steel at joint line.
2. The Soff-Cut saw shall be used immediately after final finishing and to a depth of 1-1/4". A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness. Remove all residue caused by sawing by water blasting immediately after joint is cut.
3. Contractor may form joint following dimensions provided in the Drawings.

F. Joint Filler: Joint filler shall be installed where indicated in the Drawings. Joint filler shall be full depth of joint and shall be set flush with exposed concrete surface, except where sealant or a reveal is indicated, in which case the joint filler shall be set back as detailed in the Drawings.

3.5 EMBEDDED WORK

A. General: Locate, set and build into the Work such embedded items as are required by the Work of this Section and by the Work of other Sections and Divisions of this Specification.
1. All embedded items required for adjoining Work or for its support shall be placed prior to placing of concrete and, where practicable, prior to placing reinforcing steel.
2. All other trades whose Work is related to cast-in-place concrete Work or whose work must be supported by cast-in-place concrete shall be given ample notice and opportunity to install or furnish embedded items before the affected concrete is placed.
3. Obtain setting diagrams and instructions from the supplier of item to be set and follow instructions implicitly.
4. Provide templates, set accurately to line and to level by transit and/or by laser level and anchor securely so as to not displace during placing and compaction of concrete.
5. Seal, temporarily pack and protect inserts and sleeves from intrusion of concrete or concrete mortar during concrete placement operations.
6. Aluminum: No aluminum shall be embedded in or shall be installed in contact with concrete Work unless provided with an accepted protective coating.

B. Waterstops: Provide and install continuous waterstops in strict accord with manufacturer's printed instructions and with this Specification.
1. Provide continuous waterstops as follows:
   a) at all construction joints in perimeter walls below grade;
   b) at all construction joints, isolation joints and expansion joints in retaining walls;
   c) at all control joints exposed to weather;
   d) at all uncaulked construction joints exposed to weather; and
   e) elsewhere where indicated in the Drawings.
2. Use maximum practical length to keep butt joints to a minimum.
3. Splice waterstops to form a continuous watertight seal. At junctions, use special shop fabricated ells, tees, and crosses. In slabs, turn up waterstops to be continuous with waterstops in walls. Thermostatically controlled electric splicers shall be used for all field splices, following procedures in strict accordance with manufacturer's printed instructions.
4. Test all field splices for water tightness with spark tester in accord with manufacturer's printed instructions.
5. Extend waterstops at least 6 inches beyond end of concrete placement in order to provide splice length for subsequent placement. Take care that both sides of waterstop are properly aligned and held firmly in place during concrete placement.
6. Secure waterstops using factory prepunched holes in the outermost rib with tie wire. Secure at intervals of not more than 15 inches on center. Except at factory pre-punched holes, do not drive nails, screws, or other fasteners through the waterstop.

C. Dovetail Slots: Install in continuous vertical strips at each place where masonry walls abut concrete walls or columns and at other locations where shown in the Drawings. Nail at 6" o.c. or closer spacing as required.

D. Post-Installed Anchors shown in the Drawings, or accepted in writing, shall be installed in strict accord with Manufacturer's Printed Installation Instructions. Anchors may be placed in block or brick work only where voids within 9 inches of the anchor have been filled solidly, with grout. Set perpendicular to concrete surface. Drilled hole shall be cleaned thoroughly with compressed air or water jet at the time of the setting of anchor.

E. Pipes and Conduit: Location and spacing of piping and of electrical conduit embedded in structural concrete shall conform to Contract Documents, accepted Shop Drawings, to ACI 318, and to *Building Code*. Do not place pipes or conduits in concrete Work except where shown in accepted Shop Drawings.

3.6 SLABS-ON-GROUND

A. Codes: Slabs-on-ground shall be constructed in accordance with ACI 302.1R *Guide for Concrete Floor and Slab Construction* and ACI 360R *Design of Slabs on Grade.*

B. Porous Fill: Work under this Section includes furnishing, placing and compacting of crushed stone under all slabs-on-ground. The porous fill shall be a total of 6 inches thick, crushed stone, unless otherwise shown in the Drawings, and shall be reasonably level.
   1. Crushed stone shall be compacted in 6 inch maximum lifts using not less than four passes of a Wacker Vibratory Plate compactor or equivalent of sufficient capacity to achieve maximum density of the compacted porous fill.
   2. The top of the compacted porous fill shall be not higher than the theoretical elevation taken from the Drawings.

C. Vapor Barrier: Provide over crushed stone. Overlap at joints and bond together with continuous lines of mastic, adhesive or tape in strict accord with manufacturer's printed instructions and ASTM E1643. Repair all punctures and tears just prior to pouring slab and maintain watertightness.

D. Piping, floor drains, electrical conduit and other items which are scheduled to be placed in the compacted fill shall be properly placed and tested by Contractor and accepted prior to the placement of the vapor barrier.

E. Support Reinforcement securely, on chairs with base plates or with precast concrete blocks, all as specified herein, or use other methods described in Shop Drawings and accepted.

F. Geotextile Filter Fabric shall completely surround gravel drainage courses containing underdrains.

G. Subgrade: Immediately prior to placing concrete; wet subgrade thoroughly.

3.7 MIXING AND DELIVERY OF CONCRETE

A. Ready-Mixed Concrete: All concrete shall be ready-mixed concrete. Measure, mix and deliver in accordance with ANSI/ASTM C 94, *Specification for* Ready-*Mixed Concrete*, and ACI 304R, Chapters 2, 3, 4, and 5 *Guide for Measuring, Mixing, Transporting and Placing Concrete*.
   1. Plant equipment and facilities shall conform to the Check List Certification of Ready-Mix Concrete Production Facilities of the National Ready Mixed Concrete Association.
   2. Ready mix equipment shall be completely automated.
      a) Computerized batch/truck ticket printouts shall be delivered to the Owner or Owner's inspection agency at time of concrete delivery to job site.
   3. Provide site equipment in sufficient time to permit inspection, calibration, adjustment and repair as may be required before start of concrete Work.
   4. Admixtures shall be measured and inserted into the mix at the plant except where written exceptions are obtained.
   5. If accepted by Structural Engineer, subject to the following conditions, water and/or admixtures may be added to the concrete at the site:
      a) Design mixes indicate water and/or admixtures to be added at the site.
      b) Batch/truck tickets indicate the maximum amount of water and/or admixtures that can be added without exceeding the maximum specified water/cementitious ratio or admixture dosage.
      c) Water and/or admixtures are added in a manner to control volume.
      d) Concrete is properly remixed after addition of water and/or admixtures.
      e) Dosage and time of addition at the site are reported on batch/truck tickets and signed by Contractor's site quality control supervisor.

B. Hand-Mixed Concrete shall be used only where accepted specifically. Such concrete shall be mixed only in watertight containers, with dry materials measured by loose volume, sand and cement mixed together dry prior to adding coarse aggregate. Water, when added, shall be applied slowly with the entire mass turned to provide for an even mixture at all times.

C. Hot and Cold Weather: Comply with ACI 305 for hot weather and with ACI 306 for cold weather concreting.
   1. Where air temperature is between 85°F (30°C) and 90°F (32°C), reduce the mixing and delivery time from 1-1/2 hours to 1-1/4 hours; where air temperature exceeds 90°F (32°C), reduce mixing and delivery time to 60 minutes.
   2. Where air temperature is below 40°F (4°C), uniformly heat both water and aggregates to obtain a concrete mixture with a temperature both above 50°F (10°C) and below 80°F (27°C) at all times of mixing, transportation and placement.
   3. Use accelerating admixture in concrete for slabs placed at ambient temperatures below 50°F (10°C).

D. Cement: At its own expense, Contractor will be required to test or to retest cements which may be contributing to nonconforming concrete, may have been damaged in transit or storage or may have been retained at mixing plant for 30 days or longer.

3.8 PLACING CONCRETE

A. Codes: Concrete shall be placed in accordance with ACI 304R, *Guide for Measuring, Mixing, Transporting and Placing Concrete*, and shall be handled with due care to prevent deterioration due to delay or handling. Concrete shall be consolidated in accordance with ACI 309R.

B. Clean Reinforcement, whether existing, previously placed, or placed for the pour, to a condition not less clean than is required by this Specification, including referenced, cited and stipulated Codes and Standards.

C. Clean and Seal Formwork: Formwork shall be clean and free from frost, papers, sawdust, dirt and debris immediately prior to and during the time concrete is placed thereon.

D. Concrete Pumping: Subject to the provisions of this Specification, ACI 304R - Chapter 9 and ACI 304.2R, concrete may be conveyed and placed by pumping. Concrete shall be pumped through lines 5 inches in diameter or larger. Pumped concrete mix should provide the maximum practicable coarse aggregate content. Lightweight aggregate, where proposed for pumping, shall contain optimum moisture content for pumping, but not less than 16 percent absorbed moisture, based on the oven-dry weight of the lightweight aggregate. Pump lines shall be properly lubricated per ACI 304.2 prior to commencement of concrete placement.

E. Slump: Concrete with slump exceeding the limits specified herein shall not be placed in the Work. Concrete with excessive slump shall be removed immediately from the site or may be used as lean concrete.

F. Conveying of Concrete: This Specification contemplates movement of fresh concrete from the point of receipt to the location of final deposit by concrete pumps, chutes, concrete bucket, pneumatic-tired buggies and combinations of the foregoing methods. Canvas or rubber "elephant trunks" of appropriate lengths shall be used to limit free fall of concrete. Chutes shall not be used to transport concrete for distances in excess of 30 feet (9 m) nor shall chutes be sloped greater than 1 vertical to 2 horizontal. Baffle plates shall be provided and other means shall be taken to prevent segregation. All devices used for conveying concrete shall be watertight, shall not allow concrete to come in contact with uncoated aluminum or with aluminum alloys and shall be cleaned thoroughly prior to use.

G. Protect Formwork including metal deck formwork, from damage by conveying equipment and systems.

H. Clean, Tighten, Soak and Bonding Compound: Prior to placing fresh concrete, retighten forms against previously placed concrete. Existing and previously cast concrete surfaces shall be first cleaned of laitance and deleterious materials, the surfaces shall be then roughened so as to remove all loose or damaged material that may be present. Finally, concrete surfaces shall be soaked with water. Standing water shall be removed. In addition to soaking with water, apply bonding compound in accordance with manufacturer's printed instructions to the following:
   1. Vertical surfaces along slab-to-slab, slab-to-wall, and beam-to-beam joints.
   2. Horizontal surfaces along slab-to-wall joints.
   3. Other surfaces where indicated in the Drawings.

   Contractors procedures shall recognize that substantial shearing stresses in the horizontal plane are carried across most construction joints.

I. Coordination of Concrete Placement: The batch plant, transit, conveying and placing operations shall be coordinated so that all concrete is in its final position within 1-1/2 hours from the time the mix is charged with water. Do not place concrete warmer than 90°F (32°C) except as provided in this Specification; for Architectural Concrete, the acceptable temperature of deposited concrete shall be between 50°F (10°C) and 86°F (30°C); for slab-on-ground concrete, the acceptable temperature of deposited concrete shall be between 50°F (10°C) and 70°F (21°C). The batching plant shall either provide chilled batch water or substitute crushed ice for part of the mixing water if required to satisfy specified concrete placing temperatures. Coordination shall be performed so that every deposit placed in the forms shall be covered by a subsequent deposit and consolidated within 15 minutes and in a continuous manner. Truck delivery, truck charging, crane positions, bucket size, tremie numbers and locations, lift heights, etc., shall be planned and directed toward achieving homogeneous and consistent placements.

J. Placement of Concrete: Do not begin until all reinforcing has been placed, secured, and inspected. Partially hardened or retempered concrete shall not be used in the Work. Concrete placement shall be carried out in a continuous manner between construction joints and at such a rate that freshly deposited concrete may be uniformly integrated and made homogeneous at all contact surfaces with preceding deposits of concrete which shall remain both plastic and properly workable by vibration.
   1. Placement of concrete elements supported by columns, walls, piers and the like, shall not commence until the supporting concrete is no longer plastic and, in any event, not before a 4 hour waiting period is fully expired.
   2. Concrete shall be deposited as near as practicable and possible to its final position in the structure. Placement procedures shall avoid segregation due to rehandling or due to the lateral flowing of concrete induced by gravity or by vertical dropping. To minimize segregation, concrete may not be dropped between reinforcing steel curtains and cages, nor through successive reinforcement grids. Without special acceptance, vertical free fall of concrete shall be limited to 4 feet.
   3. Procedures which cause or contribute to excessive segregation of aggregates or cause non-uniform concrete mixtures shall not be used and will be rejected.
   4. Place concrete at slumps and using procedures which will produce a homogeneous, properly compacted concrete with uniform finished surfaces.
   5. Concrete shall not be placed onto or under water except where permitted specifically by the Drawings or by this Specification.

K. Cold Joints are defined as joints wherein concrete on one side has hardened sufficiently so that fresh concrete does not mix thoroughly with that concrete. Cold joints, should they occur, shall result in the immediate stoppage of all placement operations. Detailed drawings showing remedial measures, including removal of material, the drilling-in of dowels and anchors, the construction of keys and specially roughened construction joints by bush hammering and all else will be required prior to placing contiguous concrete.

L. Layering: Concrete may not be placed in layers exceeding 2 feet in depth. Each layer shall be vibrated to the extent necessary to remove voids, honeycombing and the like.

M. Vibration: In accordance with ACI 309R, concrete shall be compacted thoroughly by vibrating to produce a dense, homogeneous mass without voids or pockets and shall be accomplished only by experienced operators. Internal vibrators shall be placed in the concrete vertically and shall penetrate at least 3 to 4 inches into the preceding lift in order to thoroughly blend adjacent layers. Vibrating techniques shall assure that the matrix is thoroughly and uniformly distributed around all coarse aggregate, including at form faces, thereby providing uniform dense concrete throughout the entire concrete volume. Vibration shall not be used as a means of transporting concrete. Following top-out leveling of exposed columns, walls and spandrels, concrete shall be allowed to set for 10 to 15 minutes, and shall then be given a final vibration and compaction, 1'-0" deep. Work concrete thoroughly around waterstops and other embedded items.
   1. Where vibrating concrete with epoxy coated reinforcement, provide vibrators with rubber covered heads and otherwise preclude damage to the epoxy coating.
   2. At exposed concrete faces, take care not to damage form liners or face of formwork.

N. Pinholes: Voids or holes larger than 1/4 inch in largest dimension shall be repaired under the provisions of this Section.

O. Epoxy Injection: Place concrete at a slump and consistency which will result in dense, waterproof in-place concrete without shrinkage cracks. Should cracking occur, repair by epoxy pressure injection using an accepted injection procedure and low viscosity, 100% solids, moisture insensitive, non-shrink, two-component epoxy.

P. Slopes to Drains: Lay out screed lines and finish top of concrete surfaces to provide sloped surfaces as shown in the Drawings and as required to produce free-draining surfaces.

3.9 OTHER CONCRETE WORK

A. Cement Grout:
   1. Grout all elevator door sills and other items indicated in the Drawings. Grout openings in concrete around conduit, piping and other Work passing through concrete except where non-shrink grout is specified or shown. Mix, place and cure as provided by this Specification.
   2. Drypack grout at beam pockets in concrete walls as shown in the Drawings. Pack grout solidly, fill entire area to be grouted, and provide complete bearing with no voids. Cure for seven days.
   3. Where required herein or by the Drawings, fill form tie holes with grout matching surrounding concrete color. Cure for seven days.

B. Non-Shrink Grouting: Provide formwork for grouting, install flowable non-shrink grout, cure, remove grout forms and seal and protect exposed grout edges, all in strict accord with the printed instructions of the grout manufacturer.

C. Curbs: Strip formwork while still green and steel-trowel surfaces to a hard, dense finish. Provide corners, intersections and terminations that are slightly rounded.

D. Concrete Fill for Steel Pan Stairs shall be normal weight, pea gravel concrete.
   1. Reinforce with welded wire fabric or as provided in Shop Drawings, but not less than 2" x 2" by 14 gauge extending over full area of each tread and landing.
   2. Steel trowel finish.
   3. Provide abrasive aggregate at a rate of 1/4 pound per square foot tamped and troweled lightly into the surface for all exterior stairs.
   4. Cure for seven days.

3.10 CONCRETE FINISHES AND TREATMENTS

A. General: Bring surface to level with screeds and strike off. Smooth the resulting surface with bull floats or darbies to remove both high points and low points. Do not add water to or disturb the plastic surface prior to finishing. Accomplish all finishes in accord with ACI 301, except where more stringent requirements are given in this Specification.
   1. Unless otherwise provided under this Specification, all flatwork shall receive a monolithic steel troweled cement finish.
   2. Where finished floor is located above the top of the structural slab, provide all required fill and cement finish required to bring floor to final grade or to underside of final finish, as appropriate.

B. Screeding for Elevated Floor Surfaces: The intent of this Specifications is to provide a slab which is screeded and finished so that the finished slab is horizontal (or sloped as given in the Drawings) and so that the slab thickness equals the thickness given in the Drawings, within the tolerances specified herein.
   1. The act of striking off the surface of the concrete to a predetermined grade shall be accomplished with the aid of rigid screed guide. The use of wet screed guides is to be avoided on all elevated surfaces.
   2. Set screeds so that slab surface is horizontal (or sloped as given in the Drawings).
   3. Floor construction, including metal deck floor construction, may continue to deflect for a short period after strike off; subsequent restraightening of the surface may move concrete paste from over beams into the resulting depressions. Contractor should plan for sufficient initial slab thickness over beams to accommodate restraightening of the surface while still maintaining adequate concrete cover and minimum slab thickness over the beams.
   4. Grade for initial strike off shall be established using grades required by the Contract Documents, making use of control points spaced at intervals not greater than 12 feet in each direction.
   5. Conformance of strike off to desired grade shall be confirmed during concrete placing operations at regular intervals after sufficient load has been applied to the supporting formwork to cause initial settlement to take place.
   6. Elevation bench marks shall be provided at each column and wall element for use by the finishers as a guide when they are completing the finishing in these areas.

7. Steel and Precast Beams: All beams have some camber, natural or induced. Cambers will likely not be uniform from beam-to-beam. Contractor shall set the grade of screeds to achieve the minimum slab thickness, while maintaining levelness and flatness within the specified limits. Where required, the maximum slab thickness may exceed the specified limits.
8. Unshored Steel and Precast Beams: It is known that beams and girders will deflect under the weight of the fresh concrete. Beam cambers, if any, may not compensate for the actual beam and girder deflections. Contractor shall reset the grade of screeds so as to achieve the minimum slab thickness, while maintaining levelness and flatness within the specified limits.

C. Flatwork Finishes: Apply the following finish types as required by the Drawings and by this Specification:
1. Float Finish: Required for concrete flatwork surfaces which will receive trowel finish, roofing, waterproofing membrane, insulation, sand-bedded terrazzo and similar finishes, composition troweled floor finish, or "floating slabs". After the concrete has been placed, struck off, consolidated and leveled, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared and/or when the mix has stiffened sufficiently to permit the proper operation of a power-driven float. The surface shall then be consolidated with power-driven floats. Hand floating with wood or cork faced floats shall be used in locations inaccessible to the power-driven machine. Immediately after leveling, the surface shall be refloated to uniform, smooth, granular texture. Wet cure for seven days.
2. Troweled Finish: Required for all concrete flatwork surfaces which will be exposed, or which will receive resilient flooring, carpeting, thin-set floor covering, paint and other thin-film finishes, waterproofing and roofing systems, and any other floor covering requiring a smooth base slab. First, achieve a float finish, and then:
    a) After the concrete has been placed, struck off, consolidated, screeded and floated, and as soon as the condition of the slab permits, and before it has hardened appreciably, all water film and foreign material which may work to the surface shall be removed by means of lutes.
    b) Prior to removal of screed, the surface shall be checked for flatness and levelness, and filled or cut down where necessary. Rough finishing shall be repeated with straightedge and float.
    c) The surface shall be troweled at least twice to a smooth dense finish.
    d) The first troweling after power floating shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but which may still contain some trowel marks.
    e) Where required, additional troweling shall be done by hand after the surface has hardened sufficiently. The finished surface shall be dense and smooth, free of any trowel marks, uniform in texture and appearance. On surfaces intended to receive floor covering, defects that would show through the floor covering shall be removed by grinding.
    f) Concrete surfaces to receive membrane waterproofing shall receive a trowel finish which leaves the surface smooth and dense, free of voids, projections or ridges.
    g) These surfaces shall be wet cured for seven days, unless a strippable curing compound is used.
3. Exposed Float Finish: Required for interior and exterior paving, where indicated in the Drawings, and for the tops of all exposed walls. Use "troweled finish" with a wood or cork float. Wet cure for seven days.
4. Exposed Broom Finish: Required for exterior paving surfaces and at other surfaces where indicated in the Drawings. Consult with Construction Manager and with Architect for texture and direction of texture at each area to receive broom finish. After floating use push broom with 1/16" diameter bristles. Brush consistently and continuously across each area designated, perpendicular to direction of traffic. Wet cure for seven days. Apply waterproofing and chloride ion screen.

D. Floors: Thoroughly clean all waste material from floors as soon as each segment of Work is completed, and protect Work which may be damaged by this operation in an accepted manner. Be responsible for fallout and for protecting persons, adjacent work and property. Comply with requirements of the *Building Code* and all agencies having jurisdiction.

E. Deicing Chemicals: In a freezing environment, it is anticipated that Contractor may need to provide or may be required to provide deicing chemicals for use on slab surfaces. The storage and the use of such chemicals is subject to the following requirements:

1. Contractor's attention is drawn to the fact that such chemicals have led to the destructive corrosion of reinforcing steel and to other problems in structures such as this one (including apartments, laboratories, office buildings, schools, and the like).
2. Storage of such chemicals shall be provided with a complete and an effective barrier to the supporting concrete.
3. Where such deicers are placed on slabs, they shall be swept up at the earliest practical moment. Where directed, sweeping shall be followed by a wash-down operation.
4. Deicing chemicals and barrier systems shall be fully compatible with all subsequent finishes and toppings.

F. Structural Repairs: Conform to Section 5.3.7 of ACI 301, *Specifications for Structural Concrete*, and to accepted procedures. Use the specified polymer repair mortars and epoxy adhesives. Proposed structural repairs need be submitted and approved prior to performing the repair.

G. Out-of-Form Concrete: Achieve the following finish as required by the Drawings, and by this Specification:
1. It is the intent of this Specification that all painted concrete and all exposed unpainted concrete be cleaned, dressed, and receive a grout clean down. Offsets shall be leveled and ground where necessary. In the event remedial action is required, it shall consist of cutting and patching. Causes for remedial action include rock pockets, honeycomb and spalling.
2. Clean shall mean the removal of all stains, laitance, transferred form oil, curing compound residue, and dirt from the surface in a manner which avoids staining, scarring or scratching the surface. Surfaces to be painted shall be cleaned ready to receive paint. Coordinate with Paint Section of this Specification.
   a) Apply cleaning/finishing solution in an even manner, break-to-break or joint-to-joint, on surface; allow to set before flushing with a pressure spray. Accomplish in a consistent manner throughout project.
   b) Treatment shall produce a "matte" surface by removing just the surface of the cement-paste skin.
3. Dress shall mean removal of all runs, splatters, fins and projections in a manner which avoids scarring, staining or scratching the surface.
4. Cutting and Patching shall mean the removal of unsound concrete, the wetting of the effected area, the application of a fine aggregate (#30 screen) and cement matrix matching the in-place concrete, to repair surface voids, honeycomb, rock pockets and spalling and the filling of tie holes, and the application and curing of the applied matrix. Patches shall be compacted thoroughly, screeded a little high, and finished flush with float or trowel. Patches shall be kept continuously moist for not less than 7 days.
5. Grout Clean Down shall mean the application to freshly hardened concrete a water/cement/sand mix as specified herein. Wet surface of concrete to prevent absorption of water from grout and apply with a trowel or brush, completely filling all air bubbles and holes. Immediately after application of grout, float surfaces with cork float, scouring vigorously. While grout is still plastic, finish with sponge rubber float, removing all excess grout, being careful that grout will not pull from holes or depressions. Allow surface to dry until it takes on a powdery appearance, then rub vigorously with dry burlap to completely remove dried grout leaving no visible film after rubbing. Complete application operation up to but not past break-to-break or joint-to-joint on the same day and do not leave grout overnight. Keep damp by fog spray for not less than 36 hours after rubbing.

H. Waterproofing and Chloride Ion Screen: Apply two coats to exposed concrete surfaces. Apply after cleaning, but prior to patching. Use airless spray and apply in strict accord to manufacturer's printed instructions. Apply consistently, working joint-to-joint and break-to-break.

I. Install Composite Drain Material over outside face of all walls retaining earth and at other locations given in the Drawings. Where material is shown specifically in the Drawings to be used as a concrete form, provide with filter face on both sides of separator; at all other locations, install with filter face on the earth face only of the separator. Take care to not damage waterproofing or dampproofing on walls.

3.11 CURING, SEALING,HARDENING, DENSIFYING AND PROTECTION

A. Curing Formed Concrete: Conform to all applicable recommendations of ACI 305, ACI 306, and ACI 308.
1. Protect newly placed concrete against rain wash, low and high temperature effects and against premature loss of moisture.

2. Heating of concrete for curing in cold weather shall be by means and methods which do not cause carbonization effects in the concrete. Erect wind breaks and weather protection when and where required.

B. Wet Curing shall be for at least seven days at a temperature of at least 50°F (10°C) by continuous fog spray, immersion in water-tight covering of polyethylene to retain moisture or other accepted means. Do not use chemical curing on surfaces to be wet cured without specific acceptance.

C. Curing Compounds: Concrete may be cured with the specified curing compound providing the following requirements can by met:
1. All exposed interior slabs, not receiving a liquid densifier, and troweled slabs receiving mastic applied adhesives or "shake-on" hardeners shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and Architectural Concrete, not receiving a penetrating sealer, shall be cured with the specified clear, non-yellowing curing and sealing compound. Maximum coverage shall be 400 ft^2/gallon on steel troweled surfaces and 300 ft^2/gallon on floated or broomed surfaces for the curing/sealing compound.
2. Strippable Curing Compound: All slabs, where indicated on the drawings or where approved, shall be cured with the specified strippable curing compound applied in strict accordance with the manufacturer's recommendation.
3. Compounds which diminish bond or adhesion of finish materials, topping slabs, mortars and the like to concrete surfaces shall not be used or shall be totally removed prior to installation of affected Work. Contractor shall coordinate respective subcontractors and shall be solely responsible to determine and to assure compatibility of curing compound with both concrete and with overlying materials.

D. Liquid Densifier/Sealer:
1. Apply liquid densifier/sealer on exposed interior floors subject to small hard-wheeled vehicular abrasion and "shake-on" hardener slabs as indicated on the Drawings.
2. Compound shall be mechanically scrubbed into the surface in strict accordance with the directions of the manufacturer and just prior to completion of construction.
3. Compounds which diminish bond or adhesion of finish materials, topping slabs, mortars and the like to concrete surfaces shall not be used or shall be totally removed prior to installation of affected Work. Contractor shall coordinate respective subcontractors and shall be solely responsible to determine and to assure compatibility of curing compound with both concrete and with overlying materials.

E. Polymer Repair Material for Leveling Low Spots shall be mixed, applied, cured and finished in strict accordance with the recommendations and instructions of the manufacturer.

F. Protection: Protect concrete Work from overloading and from defacement of any nature during construction operations.

G. Waterproofing and Chloride Ion Screen: Apply compound where specified and where shown in Architectural or Structural Drawings. Follow explicitly manufacturer's printed instructions.

3.12 FORM REMOVAL AND RESHORING

A. General: Forms and/or shores and reshores shall be removed only after the supported concrete has achieved sufficient strength to allow the structure to support the weight of concrete plus all superimposed live loads and lateral forces including construction live loads to be placed thereon, without damage to the structure, overstress or excessive deflection. Contractor shall perform, at no expense to Owner, all tests and calculations needed to show when forms, formwork supports, shores and reshores can be removed without endangering the structure, subject to the following limitations:
1. Contractor shall be solely responsible for proper removal of forms and maintenance of safe working conditions for personnel.
2. Do not damage arises or exposed concrete surfaces with tools or other devices when removing formwork. Repair or replace, as directed, all Work damaged due to improper or early removal of forms.

B. Vertical Forms may be removed 24 hours after concrete is placed contingent upon concrete having been maintained throughout that period at temperatures in excess of 50°F (10°C), upon achieving concrete strength adequate for stripping, and provisional on the implementation of effective curing procedures.

C. Soffit and Supporting Forms: Where early form removal or reshore removal is proposed, Contractor shall provide concrete cylinders, field-cured in the same temperature and moisture environment as the concrete under consideration. Where field cured cylinders are used, Contractor shall be responsible for all costs of casting, curing, transporting and testing cylinders and reporting results promptly.

D. Earth Retention Walls: Do not backfill against walls until all Work is in place which braces both the top and the bottom of walls against lateral motion until concrete has attained its full design strength and until waterproofing, dampproofing and insulation is in place.

END OF SECTION

SECTION 042100

BRICK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clay Masonry Units
B. Reinforcement and Anchorage
C. Expansion Joints
D. Mortar
E. Flashing
F. Weeps

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.
B. Section 04 05 13.23 - Surface Bonding Masonry Mortaring
C. Section 04 05 16.26 - Engineered Masonry Grouting.
D. Section 04 05 19.19 - Masonry Cavity Drainage, Weepholes, and Vents*.
E. Section 04 20 00 - Unit Masonry.
F. Section 04 73 00 - Manufactured Stone Masonry.
G. Section 05 40 00 - Cold-Formed Metal Framing.
H. Section 05 50 00 - Metal Fabrications.
I. Section 06 11 00 - Wood Framing.
J. Section 07 16 00 - Cementitious and Reactive Waterproofing.
K. Section 07 25 00 - Weather Barriers.
L. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.
M. Section 07 62 00 - Sheet Metal Flashing and Trim.
N. Section 07 65 26 - Self-Adhering Sheet Flashing.
O. Section 07 90 00 - Joint Protection.

1.3 REFERENCES

A. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
B. ASTM A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
C. ASTM A 615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
D. ASTM A 775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
E. ASTM A 996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
F. ASTM A 1008 - Standard Specification for Steel Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened and Bake Hardenable.
G. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile. 9.
H. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
I. ASTM C 150 - Standard Specification for Portland Cement.
J. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
K. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
L. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.
M. ASTM C 652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale).
N. ASTM D 1056 - Standard Specification for Flexible Cellular Materials, Sponge or Expanded Rubber.
O. Brick Industry Association (BIA) - Technical Note 20, Cleaning Brickwork.
P. TMS 402 - Building Code Requirements for Masonry Structures.
Q. TMS 602 - Specification for Masonry Structures.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
C. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
   1. Product Data for Credit MR 5.1 and Credit MR 5.2: Submit data, including location and distance from Project of material manufacturer and point of extraction, harvest or recovery for main raw material.
      a. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
D. Selection Samples: For each finish product specified, two complete sets of brick samples showing range of color and texture to be expected.
E. Verification Samples: For each finish product specified, two samples representing actual color and texture of the brick specified.
F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
C. Brick Tests: Sample and test shall be in accordance with ASTM C 67.
D. Test Reports:
   1. Testing and reports shall be completed by an independent laboratory.
   2. Test reports for each type of building and facing brick shall be submitted to the Architect for review.
   3. Test reports shall indicate:
      a. Compressive strength.
      b. 24 hour cold water absorption.
      c. 5-hour boil absorption.
      d. Saturation coefficient.
      e. Initial rate of absorption.
      f. Efflorescence.
E. Mock-Up: Provide a mock-up panel for each type of brick specified for evaluation of color, texture, joint size, and workmanship to be used.
   1. Size, minimum of 4’ x 4’ width and height
   1. Locate in areas designated by Architect.
   2. Do not begin installation of brickwork until the Architect approves the mock-up(s).
   3. Build as many mock-ups as required to obtain the Architect's acceptance. Remove unacceptable mock-ups from the site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store materials to prevent damage due to moisture, contamination, breakage, chipping or other causes.
C. Store materials on pallets or stable aggregate bed to reduce contamination and soiling. Cover with a non-staining waterproof membrane allowing for airflow around brick while protecting it from airborne contaminants and wind-borne dirt.

1.7 ALLOWANCES

A. Allowances: Include allowance stated under provisions of Section 01 20 00 - Price and Payment Procedures Price and Payment Procedures. Allowance includes furnishing face brick, and hollow brick units. Material allowance and Installation is included in this Section and is part of Contract Sum/Price.

1.8 PROJECT CONDITIONS

A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.
B. Cold Weather Procedures:
   1. Preparation:

a. If ice or snow has formed on the masonry bed, remove it by carefully applying heat not to exceed 120 degrees F until the surface is dry to the touch.
b. Remove any brick units or mortar that is frozen or damaged.
c. When the clay masonry unit suction exceeds 30 grams per minute per 30 square inches, sprinkle with heated water as follows:
1) When units are 32 degrees F or above, heat water to 70 degrees F or above.
2) When units are below 32 degrees F, heat water to 130 degrees F or above.

2. Work in Progress:
a. Air temperature 40 degrees F to 32 degrees F: 1) Heat sand or mixing water to produce mortar temperatures that match air temperature.
b. Air temperature 32 degrees F to 25 degrees F:
1) Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
2) Maintain temperature of mortar on boards above freezing.
3) Installation in colder air temperatures will require heat sources on the wall and the use of windbreaks or tents to create a controlled environment suitable for proper bonding and curing.

3. Completed Work and Work Not in Progress:
a. Mean daily air temperature of 40 degrees F to 32 degrees F: Protect masonry from rain and snow for 24 hours by covering with a weather-resistive membrane.
b. Mean daily air temperature of 32 degrees F to 25 degrees F: Cover masonry with a weather-resistive membrane for 24 hours.
c. Mean daily air temperature of 25 degrees F to 20 degrees F: Cover masonry with insulating blankets for 24 hours.

C. Hot Weather Procedures:
1. When ambient temperature exceeds 90 degrees F and wind exceeds 8 miles per hour:
a. Maintain temperature of mortar and grout between 70 degrees F and 120 degrees F.
b. Limit the spread of the mortar bed to 4 feet and place units within 1 minute of spreading mortar.
c. Control moisture evaporation in partially or newly completed walls by fog spraying with potable water, covering with opaque plastic or canvas or both.

2. Protection of Work in Progress:
a. Covering:
1) Cover tops of walls with a strong waterproof membrane at the end of each day or work shutdown. Extend the waterproof membrane cover a minimum of 24 inches down the side of each wall.
2) Hold cover securely in place.
b. Load Application:
1) Do not apply uniform floor or roof loading for at least 12 hours after completing columns and walls.
2) Do not apply concentrated loads for at least 3 days after completing columns and walls.
c. Staining:
1) Prevent grout and mortar from staining the face of masonry.
2) Remove grout and mortar that comes in contact with masonry units immediately.
3) Protect sills, ledges and projections from mortar droppings.
4) Protect base of wall from rain-splashed mud and mortar splatter.
5) Turn scaffold boards on edge when work is not in progress to lessen splattering.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Triangle Brick, Belden Brick, or equal.
B. Substitutions: Not permitted.
C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 CLAY MASONRY UNITS

A. Norman Face Brick (for open brick screen) and Standard Face Brick (for solid brick wall): ASTM C 652, Grade SW
1. Collection. tbd.
2. Color Family: Gray, Sea Gray Velour
3. Type: Face

a. Type HBS.
b. Type HBA.

4. Sizes: Norman 3-3/8" by 2-1/4" by 11 5/8" (t by h by l) for open brick screen
Standard 3-3/8" by 2-1/4" by 8" (t by h by l) for solid brick wall

B. Minimum Compressive Strength: 14,810 PSI.
C. Maximum Initial Rate of Absorption (IRA): 10.
D. Provide brick similar in texture, color and physical properties to those available for inspection at the Architect's office and/or as supplied on the approved sample panel.
E. Shapes: Special shapes are required to be used per architectural detail(s).
F. All brick supplied shall be pre-blended by the manufacturer.

2.3 REINFORCEMENT AND ANCHORAGE

A. Steel Reinforcement:
1. Billet Steel Deformed Bars: ASTM A 615.
2. Rail Steel Deformed Bars: ASTM A 996.
3. Axle Steel Deformed Bars: ASTM A 996.
4. Epoxy Coated Steel Bars: ASTM A 775.

B. Fabricated Steel Lintels: Requirements for loose steel lintels are specified in Section 05 50 00 - Metal Fabrications.
C. Brick Anchors and Ties: Provide to sizes and types indicated on the Drawings.
1. Corrugated Ties: ASTM A 1008, 20 gauge, galvanized in accordance with ASTM A 153, Class B-2.
2. Joint Reinforcement: ASTM A 82, galvanized in accordance with ASTM A 153, Class B-2.
3. Wire Wall Ties, ASTM A 82: a. Galvanized in accordance with ASTM A 153, Class B-2.
4. Dovetail Anchors, ASTM A 1008:
a. Galvanized in accordance with ASTM A 153, Class B-2.
b. Galvanized in accordance with ASTM A 153, Class B-2.

2.4 ACCESSORIES

A. Expansion Joints:
1. Premolded Foam: ASTM D 1056, Type 2, Class A, Grade 1
2. Neoprene: ASTM D 1056, Type 2, Class A, Grade 1.
3. Sealant: Shall be in accordance with Section 07 90 00 - Joint Protection.

B. Mortar: Mortar should be mixed by proportion according to ASTM C 270 for Type N mortar
1. Portland Cement: ASTM C150, Type I.
2. Hydrated Lime: ASTM C207, Type S.
3. Sand: ASTM C144.
4. Water: Potable.

C. Flashing: Build in all flashings which enter the masonry as the work progresses Flashing are specified in Section 07 62 00 - Sheet Metal Flashing and Trim Sheet Metal Flashing and Trim and Section 07 65 26 - Self-Adhering Sheet Flashing Flexible Flashing..
D. Weeps: Weeps are to be used in conjunction with flashing materials for proper functioning of the masonry wall drainage system. The specified weep material is:
1. Cotton sash cord, 12 inches long with end laid in air cavity.
2. Plastic tube, 1/4 inch minimum diameter.
3. Plastic vents or cells.
4. Aluminum vents or cells.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Verify items provided by other Sections of work are properly sized and located.
C. Verify that built in items are in proper location, and ready for roughing into masonry work.
D. If backup substrate and other preparation work is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Remove mud, loose rust, ice and contaminants that may interfere with mortar-to-unit bonding or mortar-to-footing/brick ledge bonding.
B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Coursing:
   1. Establish lines, levels, and coursing indicated. Protect from displacement.
   2. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
   3. Lay brick units in bond indicated on the Drawings.
B. Laying Clay Masonry Units:
   1. Lay brick making sure head joints and bed joints are full of mortar.
   2. Lay brick units plumb and true to line.
   3. Where fresh mortar joins partially set mortar, remove loose brick and mortar and lightly wet the exposed surface of set masonry.
   4. When adjustment must be made after mortar begins to harden, remove hardened mortar and replace it with fresh mortar.
   5. Remove excess mortar as Work progresses.
C. Masonry Reinforcing: Install as indicated and as specified in Section 04 05 19.29 - Stone Anchors.
D. Tooling and Pointing:
   1. Tool mortar joints to shape(s) indicated on the Drawings.
   2. Tool exposed joints when they are thumbprint hard.
   3. Flush-cut all joints when they are not tooled.
   4. When re-pointing a section in a wall, rake the mortar joints to a depth of not less than 1/2 inch. Fill the joint completely with pointing mortar and tool to match the surrounding masonry.
E. Flashing:
   1. Build in all flashings that enter the masonry, as the work progresses. Install as indicated and as specified in Section 07 62 00 - Sheet Metal Flashing and Trim Sheet Metal Flashing and Trim and Section 07 65 26 - Self-Adhering Sheet Flashing Flexible Flashing.
   2. Remove any projections on the brick surface or mortar bed that might puncture the flashing material.
   3. Place through-wall flashing on a bed of mortar so that the flashing projects 1/4 inch from wall face and forms a drip edge. Overlap flashing a minimum of 6 inches.
   4. Cover flashing with mortar.
F. Weeps:
   1. Install weeps in the head joints of the first brick course immediately above the through-wall flashing. Place weeps at not more than 24 inches on center horizontally.
   2. Keep the air cavity free of mortar as much as possible. Expansion Joints:
G. Control And Expansion Joints:
   1. Install control and expansion joints as indicated on Drawings.
   2. Keep joints free of mortar and any debris that may hinder movement.
   3. Install expansion joint material and finish the joint with a sealer.

3.4 CLEANING

A. Cut out defective mortar joints and holes in exposed masonry and re-point with mortar.
B. Clean a sample wall area. Do not proceed with cleaning without Architect's approval.
C. Clean brick in accordance with BIA Technical Note Number 20 and the proprietary cleaning product manufacturer's recommendations.

3.5 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged work before Substantial Completion.

END OF SECTION

SECTION 042200

CONCRETE UNIT MASONRY

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 form unit masonry assemblies consisting of concrete form masonry units including rigid insulation within the units.
B. Related Sections include the following:
   1. Division 4 Section "Concrete Form Masonry Unit Assemblies" for CMU assemblies.
   2. Division 6 Section "Rough Carpentry" for rough bucks used at window and other openings.
   3. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
   4. Division 10 Section "Louvers and Vents" for wall vents (brick vents).
   5. Division *7* Section "Backer Rod & Caulking of CFMU Expansion and Control Joints."
C. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels for form unit masonry, furnished under Division 5 Section "Metal Fabrications."
   2. Hollow-metal frames in form unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."
D. Alternates: See Division 1 Section "Alternates" for work of this Section affected by Alternates.

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
   1. For Concrete Unit Masonry: f'm = As indicated.

1.4 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
B. Shop Drawings: Show fabrication and installation details for the following:
   1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
   2. Fabricated Flashing: Detail corner units, and other special applications.
C. Samples for Initial Selection: For the following:
   1. Unit masonry Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
   2. Sheet metal flashing colors samples.
   3. Color samples of mesh weep vent materials.
D. Samples for Verification: For the following:
   1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
   2. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, closures, and other attachments
   3. Weep holes/vents in color to match mortar color.
   4. Accessories embedded in the masonry.
E. Qualification Data:
F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
   1. Each type of masonry unit required.

a. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
2. Mortar complying with property requirements of UBC Standard 21-15.
3. Grout mixes complying with compressive strength requirements of UBC Standard 21-19. Include description of type and proportions of grout ingredients.

G. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
H. Letter of Recommendation: Provide a letter of recommendation from the CMU and CFMU manufacturer recommending proprietary cleaners and their use on their products.

1.5 QUALITY ASSURANCE

A. CFMU Installer Qualifications: An experienced installer who has been licensor trained in the installation of the CFMU product or whose work has resulted in successful CFMU installation(s).
B. CFMU Manufacturer: An experienced and licensed manufacturer in the manufacture of CFMU described for this project with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delay to the project schedule.
C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
D. Source Limitations for Form Masonry Units: Obtain exposed form masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required. Manufacture materials in concurrent batches to maintain color consistency.
E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
F. Preconstruction Testing Service: Engage a qualified independent testing agency to perform the following preconstruction testing:
1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
2. Mortar Test: For mortar properties per ASTM C109/C109M.
3. Concrete Test: For compressive strength per ASTM C31/C31M.

G. Mockups: Before installing form unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Locate mockups in the locations indicated or, if not indicated, as directed by Architect.
2. Build mockup of typical wall area as shown on Drawings.
3. Build mockups for the following types of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including accessories. Include a sealant-filled joint at least 16 inches long in each mockup.
4. Clean exposed faces of mockups with masonry cleaner as indicated.
5. Notify Architect seven days in advance of dates and times when mockups will be constructed.
6. Protect accepted mockups from the elements with weather-resistant membrane.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
9. Demolish and remove mockups when directed.

H. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store CFMU on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
1. Protect CFMU from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

2. Protect CFMU from direct sunlight/UV rays when stored more than 30 days.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of CFMU: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building CFMU walls or columns.

C. Stain Prevention: Prevent concrete, mortar, and soil from staining the face of CFMU to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
   5. Immediately clean cement residue and spills when filling the CFMU walls with concrete.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace CFMU damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in Section 2104.3 of the Uniform Building Code.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until CFMU has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect CFMU work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
   1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 PRODUCTS

2.1 PRODUCTS

A. Products: Subject to compliance with requirements provide CFMU (marketed as the OneStep Building System) manufactured by a licensed OneStep manufacturer.

2.2 CONCRETE FORM MASONRY UNITS

A. General: Provide concrete form masonry units consisting of two masonry face shells joined with High Strength Polymer cross members dovetailed into the face shells by the manufacturer with rigid insulation insert positioned to create two cavities within the concrete form masonry unit, an air space of not less than ¾ inch (20mm) and a form cavity to be concrete filled and as follows:

B. Provide shapes indicated and as follows:
   1. Provide special shapes for corners, jambs, control joints, expansion joints, bonding, and other special conditions.
   2. Provide square-edged units for outside corners, unless indicated as bullnose.

C. Exposed Exterior Concrete Form Masonry Unit Face Shells: ASTM C90-13
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.

2. Weight Classification: Normal weight, unless otherwise indicated.
3. Exposed Faces: Type____.
   a. Color:____.
4. Water Repellants
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Block Plus W-10; Addiment Inc.
      2) Dry-Block; W. R. Grace & Co., Construction Products Division.
      3) Rheopel; Master Builders.
      4) Rainbloc; ACM

D. Exposed Interior Concrete Form Masonry Unit Face Shells: ASTM C90-13
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
   2. Weight Classification: Normal weight.
   3. Finish: Exposed faces of the following general description matching color, pattern, and texture of Architect's samples.
      a. Type:____.
      b. Color:____.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
B. Hydrated Lime: UBC Standard 21-13, Type S.
C. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
D. Aggregate for Grout: ASTM C 404.
E. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
F. Water: Potable.
G. Products: Subject to compliance with requirements, provide one of the following:
   1. Water-Repellent Admixture:
      a. Dry-Block Mortar Admixture; W. R. Grace & Co., Construction Products Division.
      b. Rainbloc; ACM

2.4 CONCRETE FILL MATERIALS

A. Portland Cement: ASTM C 150, Type I/II.
B. Hydrated Lime: ASTM C270 & C207
C. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
   1. Class: Negligible weathering region, but not less than 1N.
   2. Nominal Maximum Aggregate Size: 3/8 inch (9 mm).
D. Water: Potable and complying with ASTM C 94.

2.5 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60.
B. Smooth Dowel Rods

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Shall be as specified in Division 7
B. Joint Sealant for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for sealing flashing sheets to each other and to substrates.
C. Fabrication: Shop fabricate flashings from sheet metal indicated above. Extend into wall, turned up not less than 1/2 inch behind rigid insulation and 1/2 inch out from exterior face of wall, with a hemmed outer edge bent down 30 degrees.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond-Breaker Strips: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.030 inch.
   1. Products: Subject to compliance with requirements:
      a.
      b.
      c.
B. Weep Vents: 2.5 by 4.0 by 0.5 inch, 200 denier 100% recycled polyester open weave mesh designed to allow airflow and to deter migration of insect to inside wall cavity.
   1. Color: To match mortar color.
   2. Acceptable Product:
C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Subject to compliance with requirements.
   1.
   2.
   3.
D. Expanded Polystyrene Board Insulation: Rigid Cellular, polystyrene thermal insulation with closed cells and integral high-density skin; formed by the expansion of polystyrene base resin in a molding process to comply with ASTM C-578 Type IX (2#) with height and width sufficient to abut adjacent insulation inserts in an assembled CFMU wall.
   1. Thickness: 2 1/2 inches minimum
   2. Aged R-value: Minimum R12 for overall thickness
E. Polyisocyanurate Board Insulation: Rigid insulation with reflective/radiant barrier quality foil facers on both sides, compliant with ASTM C-236/C-518.
   1. Thickness: 2 inches minimum
   2. Stabilized R-value: Minimum R14.4 (per manufacturers spec)

2.8 INSULATION MATERIALS

A. Expanded Polystyrene Insulation: Rigid Cellular, polystyrene thermal insulation with closed cells and integral high-density skin; formed by the expansion of polystyrene base resin in a molding process to comply with ASTM C-578 Type IX (2#) with height and width sufficient to abut adjacent insulation inserts in an assembled CFMU wall.
   1. Thickness: 2-1/2inches minimum
   2. Aged R-value: Minimum R12 for overall thickness
B. Foam In Place Insulation: Expanding foam products, commercially available, similar to Dow “Great Stuff” brand (See PART 3: EXECUTION, 3.6)

2.9 MASONRY CLEANERS

A. Proprietary Commercial Cleaners: Provide proprietary commercial cleaners as recommended by the masonry manufacturer for use on their products.

2.10 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water- repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or concrete.
B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
C. Mortar for Form Unit Masonry: Comply with ASTM C270, Proportion Specification.
   1. Limit cementitious materials in mortar to portland cement, and lime.
   2. For CFMU masonry below grade, in contact with earth, and above grade, use Type S.
   3. For exposed masonry provide water repellant treated mortar per water repellant manufacturer's recommended rate.

2.11 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
   1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
C. Concrete fill: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
   2. Minimum Slump: 8 inches (200 mm) Maximum Slump: 11 inches in accordance with ASTM C 143.

2.12 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
   1. Payment for these services will be made by Owner.
   2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.
B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Cut CFMU with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. For cutting, use "utility" shape CFMU.
B. Select and arrange units for exposed form unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.
D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING CFMU WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half- size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
   1. One-half running bond with vertical joint in each course centered on units in courses above and below.
C. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
D. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
E. Fill space between hollow-metal frames and masonry solidly with concrete fill, unless otherwise indicated.
F. Keep cavities clean of mortar droppings and other materials during construction.
G. Temporary Formwork and Shores: Construct temporary supports, bucks and shores as necessary to support reinforced masonry elements during construction.
   1. Do not remove temporary supports, bucks or shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.5 MORTAR BEDDING AND JOINTING

A. Lay form masonry units as follows:
   1. With full mortar coverage on horizontal and vertical face shells.
   2. Do not trowel mortar fins protruding into cavity.
B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
   1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

3.6 FOAM-IN-PLACE INSULATION

A. Install foam-in-place insulation where indicated and at voids at control joints, window bucks, window and door frames, thermal breaks and voids between rigid insulation inserts and dissimilar material.

3.7 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by form masonry unit assemblies. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor bolts, accurately located, to elevations required.
   2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.8 EXPANSION AND CONTROL JOINTS

A. General: Install expansion and control joints in form unit masonry where indicated. Place expansion joints at intervals not to exceed 24 ft. Place control joints between the expansion joints, at or near the center of the span.
B. Form Expansion joints as follows:
   1. Use full and half length units to create a continuous, through the wall vertical joins at expansion joint locations.
   2. Place expansion joint filler strips vertically into the concrete cavity at the expansion joint location.
   3. Keep the head joints of the vertical expansion joint free of mortar.
   4. Discontinue reinforcing at expansion joint. Do not run reinforcing through the expansion joint filler strip.
   5. If required, place greased/capped smooth dowel rods through the expansion joint filler strip as called for on plans.
   6. Do not run horizontal joint wire through expansion joints.
C. Form Control joints as follows:
   1. Create continuous vertical joint on exterior face only by laying “center scored control joint units” above head joint of adjoining units below, keeping head joint free of mortar.
   2. At the end of each shift, use portable masonry saw to cut through the scored portion of the center scored units to form a continuous 3/8 inch wide vertical joint in the exterior face of the wall.
   3. Reinforcing and concrete should be continuous behind control joints.

4. Do not run horizontal joint wire through control joints.

3.9 LINTEL FORMS

A. Install steel lintel forms where indicated.
B. Provide minimum bearing of 2 inches (50 mm) at each jamb, unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
   1. Extend flashing to inside of rigid insulation and turn up not less than 1/2 inch (25 mm).
   2. Extend flashing a minimum of 2 inches into masonry at each end of lintel, shelf angle, heads and sills.
   3. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a hemmed drip.
   4. Seal all laps and splices in flashing to prevent water from leaking through joints in the flashing.
B. Install vents in vertical head joints at the top of each continuous cavity at spacing indicated. Use plastic weep hole/vents to form vents.
C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 STEEL REINFORCEMENT

A. Placing Reinforcement: Comply with requirements of Section 2104.5 of the Uniform Building Code.
B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover of not less than 1/2 inch.
D. Place reinforcement prior to concrete fill placement.
E. Splice lap reinforcement not less than 40 bar diameters. Maintain not less than one reinforcement bar diameter between vertical reinforcement installations.

3.12 CONCRETE FILL PLACEMENT

A. Filling of Concrete Cavity: Do not place concrete fill until entire height of masonry to be filled has attained sufficient strength to resist hydrostatic pressure of concrete fill.
   1. Before placement of concrete fill verify that reinforcing bars are correctly positioned with proper lap and alignment, and that the cavity is free from debris, obstructions, and excessive mortar droppings that would create voids in the concrete pour.
   2. Solidly fill CFMU cavity with concrete in lifts not to exceed 10 feet in height. Stop concrete pour flush with top of cavity. Trowel concrete at slight angle downward from interior face shells toward the insulation inserts.
   3. Use mechanized concrete pump or "grout hog" style concrete dumping system to place concrete.
   4. DO NOT USE SITE MIXED CONCRETE TO FILL CFMU WALLS.
   5. Consolidate concrete by manually “rodding” vertical rebar, or by using “rebar cap style” mechanical vibrators. DO NOT USE INSERTION STYLE MECHANICAL VIBRATORS IN CFMU WALLS.

3.13 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.
   1. Payment for these services will be made by Owner.
   2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.
C. Mortar properties will be tested per UBC Standard 21-16.
D. Concrete fill testing per Division 3 Section "Cast In Place Concrete" for field quality control testing requirements.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
C. In-Progress Cleaning: Clean form unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry per masonry manufacturer's written recommendations.

3.15 MASONRY WASTE DISPOSAL

A. Excess Masonry and Waste: Remove excess masonry and waste and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 10 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 CONTRACT DOCUMENTS

A. Comply with Contract Documents:
   1. All Work of this Section shall comply with the requirements of the Conditions of the Contract (General, Supplementary, and Special), with all Sections of Division 1 - General Requirements, with this Section of the Specification, with the Drawings and with all other Contract Documents.

B. Flammable Materials or materials not conforming in all respects to the fire resistive and fire safety provisions of governing regulations shall not be left in place in the Work.

C. Disposition of and Exposure To Materials: Contractor remains fully responsible for the disposition of and for the exposure to persons of all materials, whether or not hazardous.

D. Volatile Organic Compounds (VOC): Contractor remains fully responsible for the supplying of products and materials complying to the VOC limitations set forth by the *Building Code* and by governing agencies having jurisdiction.

1.2 WORK INCLUDED

A. Scope: Contractor shall examine all of the Contract Documents for the extent of the Work of this Section of the Specifications. That Work shall include all labor, materials, devices, plants, tools, equipment, appliances and services necessary for the production, fabrication, delivery and erection, complete, of structural steelwork as shown in the Structural Drawings, as specified herein, as required by job conditions, and as required by governing authorities having jurisdiction, including but not limited to the following:
   1. Beams, columns, girders, bracing, all including connections and associated Work.
   2. Base plates.
   3. Posts, struts and hangers.
   4. Furnishing but not installing embedded items such as anchor bolts.
   5. Angles, plates and the like to support metal deck and metal grating.
   6. Galvanizing, shop and field painting, and field touch-up.
   7. Field surveying of as-erected structural steel and re-plumbing as required.
   8. Supplying and installing of lintels, where attached to structural steelwork.
   9. Bracing, guying and plumbing of structural steelwork.
   10. Protection of Work of this Section.
   11. Protection of other Work from activities under this Section.
   12. Shop Drawings and Submittals.
   13. Determination of detail dimensions, member locations and the like from information provided in the Architectural and Structural Drawings and/or as provided by Architect.
   14. Connection design by Contractor's Professional Engineer.
   15. Design of metal planks used for stair treads and floor panels, and their connections, by Contractor’s Professional Engineer.
   15. Review of Contractor-prepared Construction Sequence by Contractor's Professional Engineer.
   16. Review and development of Construction Sequence as proposed by or implied from the Contract Documents.
   17. Provisions for other Work, including holes through structural steel for other Work.
   18. Cooperate with Owner, with Construction Manager, with Architect and with Testing Agency in all aspects of quality assurance and in all other activities related to the Work of this Section 05 10 00.
   19. The safe handling and disposition of materials related to the Work of this Section 05 10 00, whether or not hazardous.
   20. All other labor, materials and Work given in the Drawings, specified herein or required to make the structural steelwork complete.

B. Work Installed as Specified Elsewhere: Contractor shall examine all of the Contract Documents for the extent of Work to be installed under this Section 05 10 00.

1.3 RELATED WORK

A. Related Work Specified Elsewhere, Amplified Elsewhere or Included in Other Contracts:
1. Submittals: Section 01 30 00.
2. Owner's shop and field testing and inspection of Work by Testing Agency engaged and paid for by Owner: Section 01 40 00.
3. Installing anchor bolts and embedded plates in concrete: Section 03 30 00.
4. Non-shrink grouting for structural steel base plates: Section 03 30 00.
5. Cast-In-Place Concrete: Section 03 30 00.
6. Masonry: Division 4.
7. Metal Deck and Field-Applied Stud Shear Connectors: Section 05 30 00.
8. Miscellaneous Metals: Section 05 50 00.
9. Metal Stairs and Railings: Section 05 50 00.
10. Finish Painting of Exposed Structural Steel: Section 09 90 00.

1.4 APPLICABLE CODES AND STANDARDS

A. General: Except as modified or voided by requirements specified herein or by details or notes included in the Drawings, Work specified under this Section shall conform to all applicable provisions of the codes, specifications, standards and other reference documents cited in this Specification and/or noted in the Drawings.

B. Requirements of Codes and Other Reference Documents:
1. Codes, standards, specifications and other reference documents cited in this Specification are declared to be a part of this Specification, the same as if fully set forth herein. Work shall conform to the applicable provisions of reference documents cited directly by this Specification and shall conform also to codes, standards and specifications, or parts thereof, cited in codes, standards and reference documents stipulated in this Specification.
2. Where provisions of this Specification supplement those of stipulated reference documents, the applicable provisions of the stipulated document(s) plus those of this Specification shall control the Work.
3. Where provisions of this Specification modify or void provisions of stipulated reference documents, the provisions of this Specification shall govern the Work, solely or in combination with the provisions of reference documents as applicable.
4. Recommendations or suggestions in the listed codes or standards shall be mandatory where not in conflict with this Specification.
5. In the event of conflict between provisions of stipulated reference documents and of this Specification or another stipulated reference document, Contractor shall report in writing the details of the conflict. Decisions regarding applicability of provisions of this Specification and provisions of reference documents applied independently or as supplemented, modified or voided, will be provided in writing and shall be final. Resolution of conflicts shall conform to the procedures set forth in the General Conditions of the Contract.

C. Codes: All Work under this Section shall conform to the requirements of the 2018 North Carolina Building Code, hereinafter referred to as *Building Code*, and to the regulations of all governmental authorities having jurisdiction. Where more stringent, the following codes, standards and specifications, latest edition and revision, shall apply to the Work, all as modified herein or by *Building Code*:
1. *Specification for Structural Steel Buildings, AISC 360*, by the American Institute of Steel Construction (*AISC*).
2. *Code of Standard Practice for Steel Buildings and Bridges*, published by the American Institute of Steel Construction (*AISC Code*). Sections 6, 7, 8 and 10, only, shall apply to the Work, except as modified in this Specification; the remainder being specifically excluded.
3. *Structural Welding Code - Steel*, AWS D1.1.
4. *Structural Welding Code - Sheet Steel*, AWS D1.3.

5. *Specification for Structural Joints Using* ASTM A325 *or A490 Bolts*, approved by the Research Council on Structural Connections of the Engineering Foundation (RCSC Specification). Endorsed by the American Institute of Steel Construction, and the Industrial Fasteners Institute.
6. *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, AWS A2.4.
7. *Structural Welding Code - Reinforcing Steel*, AWS D1.4.
8. *Specification for Design of Cold-Formed Steel Structural Members*, by the American Iron and Steel Institute.

D. Reference Documents: To the extent that the best quality of Work is provided, Work shall conform to the examples, procedures and recommendations listed below, latest edition and revision. Where provisions of the *Building Code,* this Specification, or codes, standards, manuals and specifications cited by this Specification are more restrictive or provide increased quality, the combination of provisions, examples, procedures and recommendations which provide both best quality and *Building Code* conformance shall control the Work.
1. *Steel Construction Manual,* Thirteenth Edition, by American Institute of Steel Construction (*AISC Manual*). Contractor shall keep at least one full copy in the field office at all times.
2. *Detailing for Steel Construction*, by the American Institute of Steel Construction.
3. SSPC *Steel Structures Painting Manual*, *Volume 1, and Volume 2*, by Steel Structures Painting Council.
4. *Guide for the Visual Inspection of Welds, ANSI/AWS B1.11.*
5. Qualification of Post-Installed Mechanical Anchors in Concrete, ACI 355.2.
6. Qualification of Post-Installed Adhesive Anchors in Concrete, ACI 355.4.

E. ASTM (American Society for Testing and Materials) Specifications cited in this Specification or cited in reference documents shall be the year of adoption or tentative adoption and revision listed in the latest edition of the Annual Book of ASTM Standards*, Index*, except that, should a specific year of adoption or revision be cited by the Contract Documents, by *Building Code*, or be proposed by Contractor and accepted by Structural Engineer, that edition shall apply to and shall control the Work.

F. Conformance to Regulations: Work of this Section 05 10 00 shall conform to all applicable federal, state, and local laws and regulations.

1.5 SUBMITTALS

A. General: Contractor shall submit samples, Shop Drawings, product data, test reports and data, manufacturer's names, certifications, procedures, methodology statements, and the like as stipulated. Submittals shall be in PDF format and transmitted electronically, unless otherwise accepted.
1. Review of Contractor's submittals is only for the limited purpose of the examination of submittals for conformance with the design concept of the project and to assist Contractor in ascertaining that the information given in the submittals conforms to the requirements of the Contract Documents.
2. Review of Contractor's submittals is not conducted for the purpose of determining the accuracy or the completeness of the submittal, for dimensions or quantities, or for installation or performance of the system or the piece(s) being submitted.
3. Submittals by Contractor implies that Contractor has checked the submittal with care. Where by error or other cause, Contractor's check has not been accomplished, Contractor shall not rely on review but shall first check and shall then resubmit such material as though the submittal had been rejected.

B. Shop Drawings:
1. General: Shop Drawings, as the term is used under this Section 05 10 00, are not Contract Documents, but are intended to demonstrate the way that Contractor intends to conform to the requirements provided in the Contract Documents. Contractor may wish to use these same drawings as a part of the instructions given to craftpersons for the accomplishment of the Work.
2. Best Standards: Shop Drawings furnished under this Section shall conform to the best standards of the construction industry and shall be not less complete than indicated by the applicable procedures shown in *AISC's Detailing for Steel Construction*. Shop Drawings shall be prepared by and under the supervision of competent engineering personnel. Prior to preparation, Contractor shall retain a Professional Engineer, accepted by Construction Manager and by Structural Engineer and registered in the State of this project, to supervise the preparation of and to check each Shop Drawing for compliance with the requirements of the Contract Documents.

a) Shop Drawings shall be prepared under the direction of personnel completely familiar with Architectural, Mechanical, Plumbing, Electrical and other building trades Drawings.
b) Contractor shall provide detailer with tool clearances needed for both shop and field bolted connections.

3. Shop Drawings shall be submitted for review and to governing agencies having jurisdiction for acceptance in accordance with the provisions of the Contract Documents.
4. Erection Drawings and Piece Drawings shall clearly show the size, grade and location of each member. Erection Drawings shall contain (for each piece) the erection mark, the connection mark, beam copes, the location, size and reinforcing of beam penetrations, the elevation of top of beam, (where sloped) the elevation of the work point of both ends, camber, and such projecting elements as may be of concern to Architect.
   Additionally:
   a) Show each field connection complete with data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings and by forces imposed by natural phenomena.
   b) Prepare anchor bolt, base plate and embedded plate Erection Drawings containing complete location and placing details. Include details of erection templates. Provide Erection Drawings to the concrete trade in advance of applicable Work and in coordination with concrete construction sequence.
   c) Contractor's Professional Engineer licensed in the project's jurisdiction shall review and accept Contractor's construction sequence. As evidence of conformance with this requirement, Contractor shall submit a letter bearing the seal and signature of Contractor's Professional Engineer, attesting to conformance with this requirement.
5. Shop Drawings shall include plans, elevations, sections and complete details to describe clearly, at an ample scale, all Work to be provided. Shop Drawings shall be accurately dimensioned and shall be notated clearly.
6. Size and Grade of Steel for each component part of the structure shall be indicated clearly in Shop Drawings. Rolled shapes, tubes, plates and other components shall be identified by using the standard designations used in AISC's *Detailing for Steel Construction*.
7. Symbols: Welds and nondestructive tests shall be indicated by using the symbols conforming to AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*. Indicate joint designation, welding process, and other data in the tail of the welding symbol.
8. Detail in accord with and to accommodate Contractor's field measurements of supporting and adjoining construction. Do not fabricate before accepted Shop Drawings have been returned to Contractor.
9. Work of Other Sections: Show in Shop Drawing and dimension thereon holes and other Work required for securing Work of other Sections to structural steelwork, as well as holes and other Work required for the passage of Work of other Sections through structural steelwork. Pay particular attention to the requirements of the Work specified under Section 03 30 00. Provide Field Work drawings for all such holes not shown in Shop Drawings.
10. Structural Steel Connections: Identify explicitly the type of connection used at each location. Distinguish between shop and field connections. Determine and establish the arrangement and layout of each connection to the extent that detailing options are allowed in the Drawings or in this Specification. Connections shall be proportioned by LRFD and shall conform to controlling requirements given in the Drawings, specified herein, or required by the *Building Code*.
    a) Proportion connections not completely detailed in the Drawings to resist loads and load combinations given, noted, specified or required by the Contract Documents or by *Building Code*. Include reinforcing plates, web doubler plates, stiffeners and all else required to provide adequately for the given loads and load combinations.

b) As a part of the preparation of Shop Drawings, Contractor's Professional Engineer licensed in the project's jurisdiction shall design and be responsible for the design adequacy of all connections required by the Work, unless detailed completely in the Drawings. Contractor shall submit a letter bearing the seal and signature of Contractor's Professional Engineer, attesting to conformance with this requirement. Provide supporting calculations on request.

c) Contractor shall ascertain that all connections have sufficient strength, stiffness and ductility to resist safely loads imposed by handling, shipping, erection, temporary conditions and the like.

d) Except where smaller connections are given explicitly in the Contract Documents, and except where larger connections are required to resist loads from handling, shipping erection and the like, Contractor shall provide connections for members in trusses and bracing capable of resisting not less than 50% of the tensile strength of the members.

e) Where bridging, sway bracing and the like spans from deflecting elements to rigid elements, provide temporary connections so as to allow the free motion of the deflecting element.

f) Fillet welds, partial penetration welds, weld returns, plug welds and the like shall equal or exceed the sizes given in the tables and notes included in the Drawings and in all cases shall equal or exceed the minimums permitted by *AISC Specification*.

g) Single-angle, one-sided and other types of eccentric connections shall not be used except where more concentric connections are not practical. Use of such eccentric connections is subject to prior acceptance.

11. Clearly indicate the grade, size and number of bolts, the type, number, position, designation and orientation of each washer, the bolt tension indicating system and the size of each hole, whether slotted or round. Proportion connection details to ensure adequate wrench clearance for correct bolt tensioning sequences.
12. Design and detailing of structural steel connections to plates or anchors embedded in concrete shall be based on tolerances in excess of the most severe combination of structural steel, concrete structure, and embedded item location tolerances. Refer to Specification Section 03 30 00 for tolerances for concrete structure and embedded item location, and detail structural steel to accept those tolerances.
13. Camber and Sweep: Show all camber dimensions in Shop Drawings. Where specific camber is not given in the Drawings, note in affected Shop Drawing that such members shall be fabricated with natural camber up. Detail, fabricate and erect beams and girders so that natural sweep is away from the immediately adjacent edge of slab.
14. Lintels and other secondary members requiring erection tolerances closer than those permitted herein shall be provided with appropriate slotted holes and shall be connected with ASTM A325 SC bolts. Increase member size where required to provide adequate space, edge and end distances for slots.
15. Cleaning, Surface Preparation (SSPC), and Painting data and requirements, including specific identification of "no-paint" areas, shall be detailed and scheduled in Shop Drawings.
16. Contractor shall coordinate and cross-check for accuracy, completeness and correct relationship to the Work of other Sections, each Shop Drawing prepared for the Work of this Section 05 10 00, including each Shop Drawing prepared by accepted subcontractors. Contractor's check shall include a verification of compliance with the Contract Documents and shall be performed prior to submission and resubmission of each Shop Drawing. The personally inscribed initials of the person(s) preparing each Shop Drawing as well as the detailing agency's supervisor and chief checker shall be included in the title block or similarly prominent location.
17. Deviations: Should Contractor desire a Deviation from Drawings or Specifications, or both, Contractor shall submit the specific Deviation in writing prior to the submittal of Shop Drawings showing Deviations. Requests for Deviations shall be submitted on Contractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in Shop Drawings, or both, without the required written description on Contractor's letterhead, may not be accepted and shall be sufficient cause for the rejection and the return of such Shop Drawings without further action.
    a) Acceptance of Shop Drawings including Deviations not detected during Shop Drawing review, shall not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted in writing.

18. Shop Drawing Review: Only Shop Drawings marked "No Exceptions Taken" or "Make Corrections Noted - Resubmission Not Required" may be used by Contractor in the Work. Shop Drawings marked "Make Corrections Noted - Resubmit" shall be corrected or completed (or both) as required and shall be resubmitted. This process shall be repeated the number of times required to achieve the mark "No Exceptions Taken" or "Make Corrections Noted" - "Resubmission Not Required".
    a) Review of Shop Drawings will include the following:
        i) Member size, grade, spacing and elevation.
        ii) Structural integrity of connections, including conformance to job standard.
        iii) Penetrations, including size, location and conformance to job standards.
    b) Temporary, shipping, handling or erection loadings will not be considered in this review.
    c) Nonconformities and errors detected during review will be noted in Shop Drawings returned to Contractor upon completion of review. Acceptance of Shop Drawings, including Substitutions and Deviations not detected during review, will not relieve Contractor from sole responsibility to provide Work conforming strictly to the Contract Documents.
    d) Shop Drawing review includes engineering calculations only to the extent deemed necessary to ascertain that Contractor's Professional Engineer's calculations and/or Shop Drawings have been prepared by competent personnel. Contractor alone is responsible for the accuracy and the completeness of Contractor's engineering calculations.
    e) Should Architect's or Structural Engineer's marks or corrections be made in any Shop Drawing that would or could result in incorrect fit of any part or result in insufficient strength or stability of the Work, Contractor shall so notify in writing so as to expedite the required correction or modification.
    f) Review of Contractor's Shop Drawings does not include a review of bills of material and the like. Accordingly, information required for the review of Shop Drawings shall be contained outside of bills of materials and the like.
19. Resubmission of Shop Drawings: Prior to resubmission of Shop Drawings with additions, deletions, or corrections, Contractor shall cloud and identify all changes from the prior issue. Drawings submitted without each change both clouded and identified clearly will be returned and shall be resubmitted as though the original submittal had been rejected. Each submittal, whether or not accepted or rejected, shall contain a unique revision number, clearly identified.
20. Temporary Work: Depict and identify temporary members and connections which may be required for temporary construction, erection and the like.

C. Product Data: Submit printed manufacturer's literature for each manufactured item specified under Part 2 - Products - along with test data as may be requested. Include detailed instructions for application and installation.

D. Mill Test Reports:
1. Submit certified copies of mill test reports for all steel furnished. Submit also to governing agencies having jurisdiction. Comply with all applicable parts of ASTM Specifications. Beyond ordering information normally provided by Contractor, the mill shall be instructed to color-code in accordance with ASTM A6, and to mark with heat number, size, and type and grade of steel.
2. Submit manufacturer's certification of bolts, nuts, washers, DTI's and the like for each production lot of each grade of each type and each size of fastener component and filler material for welding.
3. Mill test reports shall state clearly the governing ASTM specification and shall be certified and notarized by Contractor as conforming in all respects to that specification.
4. Material provided in accord with the above requirements may be used in the Work without further local tests. In the case of controversy, Contractor shall perform tension, bend and such other tests as are required to demonstrate compliance with the requirements of the Contract Documents.
5. All steel that is not properly identified or whose source is subject to question shall be rejected.
6. Steel pipe and tubing shall have not less than one tension, one bend, and one flattening test for each one hundred lengths or fraction thereof, for each size, for each wall thickness and for each grade. Both tension and bend tests shall be made from coupons taken longitudinally.

E. Material Identification: On completion of the Work, Contractor shall submit an affidavit, countersigned by the appropriate subcontractor(s), attesting that all materials and products provided for the Work conform to the applicable specifications, standards, yield points, grades and the like required by the Contract Documents.

F. Certification of Shielding Gas: Submit certification that shielding gas is a weldable grade having a dew point of -40°F (-40°C) or lower.

G. Names of Manufacturers/Suppliers: Submit for acceptance the names of the following products and/or producers along with certification that the products conform in all respects to the requirements of the Contract Documents:
1. plates and shapes
2. welding materials
3. shielding gas
4. stud shear connectors
5. deformed bar anchors
6. bolts, nuts and washers
7. post-installed anchors
8. anchor bolts
9. shop and field paint and galvanizing
10. coating of milled surfaces
11. gratings, treads, and planks

H. Post-Installed Anchor Certifications: Submit approved independent testing report per ACI 355 (ICC-ES report), Manufacturer's Printed Installation Instructions, letter describing installation procedures, and installer qualifications including certification for horizontal and overhead adhesive installation where applicable.

I. As-built Shop Drawings: At the completion of the Work, provide to Owner, to Architect and to Structural Engineer, one complete digital set of all Shop Drawings (including Job Standards, Erection Drawings, Index Sheets, Piece Drawings, Field Work Drawings and the like), so as to provide as-built drawings of finished and completed Work under this Section 05 10 00.

J. Governing Agencies: Provide all Shop Drawings, tests, inspections, reports, affidavits, manufacturer's certifications, certification of compliance with VOC limits, and other requirements and data to governing agencies having jurisdiction.

1.6 MEASUREMENTS, TEMPLATES AND TOLERANCES

A. Measurements:
1. Field Measurements: Obtain all field measurements required for proper fabrication and installation of Work covered by this Section 05 10 00. Submit, prior to installation, all measurements indicating discrepancies from the Drawings. Describe in writing and, where applicable, by sketches proposed methods of correcting discrepancies. Measurements are the responsibility of Contractor.
2. Lay out each part of the Work in strict accordance with the Architectural, Structural, Mechanical, Electrical, Plumbing and all other Drawings and be responsible for correct location of same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.
3. Templates: Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.
4. Field Survey: Provide all field survey mesaurements required by Construction Manager for coordination with installation of other trades.

B. Tolerances: Structural steel shall be fabricated and erected within the tolerances specified in the *AISC Specification*, *AISC Code*, and AWS, except that more or less restrictive tolerances, specifically shown or noted in the Drawings or provided under this Specification, shall take precedence and shall apply to the Work.
1. The plumbness tolerance of columns, sometimes given as 1:500, shall be taken as the square root of the sum of the squares of the slope for the two orthogonal axis.
2. The vertical dimension, measured from the column splice immediately above to the top of as-erected members framing to (or framing immediately adjacent to) the column, shall not vary by more than 1/4 inch.
3. Individual floor beams and girders shall be considered level where the difference in elevation between ends of the members does not exceed 1:750. Spandrel beams and girders shall be considered level where the difference does not exceed 1:1500.

4. The ends of all members intended to be at the same elevation shall fall between two planes not farther apart than 1/4 in.
5. Overall plan dimensions shall not vary by more than plus or minus 1:2000 for the overall length or width or two diagonally opposite extremes, all measured to the centerline of columns. Regardless of the overall plan dimension, the variance shall not exceed 1/4 in.
6. Columns shall fall within ½ inches of the best fit straight line describing the column line.
7. Camber tolerances for beams and girders, as measured in the shop, shall not exceed the following:
   For lengths to 45 feet, plus 0.5 inches, minus 0 inches.
   For lengths greater than 45 feet, an additional 1/8 inch for each 10 feet of length or fraction thereof.
8. Level column splices with shims to a tolerance of ±1/16 inch not less often than every sixth floor.
9. At concrete walls.

1.7 TESTING AND INSPECTION

A. Owner's Testing Agency: All work is subject to Special Inspection as required by *Building Code*. Subject to acceptance by Architect, Owner will engage and pay for the services of an independent testing agency (Testing Agency) as outlined in Section 01 40 00, Inspection and Testing. The selected Testing Agency will meet the requirements of ASTM E329. Contractor alone is responsible for the achieving of the required level of quality, both in the shop and in the field. Testing Agency will rely heavily on reviewed Shop Drawings, as described earlier in this Specification, in its examination of as-constructed Work. Contractor shall not retain Owner's Testing Agency for its own work but may, subject to acceptance by Owner, contract through Owner for such Work.

B. Responsibilities and Duties of Testing Agency: Testing Agency will perform the following functions, inspections and tests:
   1. On instructions and at locations selected by Architect, Testing Agency may sample materials taken from the as-erected Work.
      a) High-tensile bolts, nuts and washers, of each size and grade, may be sampled and tested in accord with ASTM procedures.
      b) Coupons may be taken from structural steel shapes and plates and welds and tested in accord with ASTM procedures.
   2. Inspectors provided by Testing Agency will be qualified to examine the materials and the systems employed in the Work. In case of dispute between Contractor and Testing Agency as to the competence of any inspector, Structural Engineer shall be the final arbiter.
   3. Both tests and inspections will comply with the requirements of the *Building Code*, as amended by the requirements and regulations of the Building Department and as Specified herein.
   4. Testing Agency will inspect all shop and field welding and high-strength bolting in accord with the provisions of this Specification. Testing Agency, upon the completion of the Work, will be required to certify in writing that the welding and the high-strength bolting has been performed in accordance with the provisions of the Drawings and with this Specification, and with the applicable requirements of regulatory agencies having jurisdiction.
   5. Testing and reporting by Testing Agency will be performed in accord with the following requirements:
      a) Testing will be performed in accord with the provisions of ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*.
      b) Liquid penetrant testing will conform to the provisions of ASTM E165 and AWS D1.1.
      c) Magnetic particle inspection will conform to the provisions of ASTM E109 and AWS D1.1.
      d) Ultrasonic, X-ray and gamma ray testing will conform to the provisions of AWS D1.1, Chapter 6.
   6. Test specimens shall be taken by Contractor under the direction of Testing Agency and shall be machined by Contractor to dimensions required by the related ASTM specification and/or AWS standard.
   7. Continuous inspection of high-tensile bolting will be performed by Testing Agency. Where the tension in any bolt is deemed to fall below the proper value, all bolts in that connection shall be examined.
      a) All bolts will be visually examined for proper tension.

b) Ten percent of the bolts, but no fewer than two bolts, selected at random from each connection in question, shall be tested for bolt tension in accord with the provisions of the *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.

8. Inspection of all shop and field welding will be provided by Testing Agency.
   a) All welds are to be visually inspected.
9. Continuous inspection of complete penetration welds will be provided by Testing Agency using ultrasonic or other non-destructive tests.
   a) Ultrasonic tests will be performed by specifically trained, qualified technicians, who will operate the equipment, visually examine the welds and will maintain records of welds examined, defects found and disposition of each defect. Technician will sign each weld that he or she inspects.
   b) Inspection instrumentation will be calibrated by the Testing Agency in accord with AWS D1.1.
   c) Welds requiring ultrasonic testing will be tested at an initial rate of 100% in order to authenticate the qualifications of each welder and each welding operator. Where the rejection rate is found to be less than 5% of the welds tested, the frequency of testing may be reduced to 25%. Where the rate of rejection increases to 5% or above, the inspection rate will again be increased to 100% until the defect rate is reduced to less than 5%. Percentages will be calculated for each welder separately.
10. Where ultrasonic indications arising from the weld root can be interpreted as either a weld defect or a back-up bar, the bar shall be removed by Contractor and back-welded, where required. The weld will then be retested. Questionable root indications, where no defect is found, will not be counted against the welder's rejection rate.
11. All material stressed transverse to the grain by welds, located within 6 inches to either side of the weld, will be tested ultrasonically for laminations. Testing will be in accord with ASTM A578.
12. Approximately 25% of groove welds accomplished in the shop will be retested in the field. Retesting will not take place until the welds are not less than 4 days old. Similarly, approximately 25% of material stressed transverse to the grain will be retested for laminar tearing.
13. All columns splices and other compression joints that depend upon contact bearing after alignment will be tested for conformance with this Section 05 10 00.
14. Perform Special Inspection of post-installed anchors in accordance with the Building Code, Manufacturer's Printed Installation Instructions, approved independent testing report per ACI 355, Contract Documents and approved shop drawings. As a minimum, provide continuous inspection of adhesive anchors installed in horizontal, or upwardly inclined orientations, supporting tension loads; and periodic inspection of all other conditions of post-installed anchors. Special Inspectors shall be qualified (via experience, training, ACI/CRSI certification, etc.) with the installation and inspection of post-installed anchors. Special Inspections shall include but are not limited to the following:
   a) Verify installer qualifications as required per the Contract Documents;
   b) Verify anchor type, material, size, length, and condition;
   c) Verify minimum concrete age, temperature, strength, and dry condition;
   d) Verify drilling method, hole cleaning, preparation per Manufacturer's Printed Installation Instructions; and
   e) Verify anchor position, setting, and installation method.

C. Authorizations: Owner's Testing Agency will not be authorized to:
   1. Authorize deviations from the Contract Documents.
   2. Assume any of the responsibilities of Contractor; for example, Testing Agency may not advise formally or informally on any aspect of construction means, methods, techniques, sequences or procedures, or safety precautions and programs in connection with the Work.
   3. Accept Shop Drawings or samples.
   4. Approve or issue a Certificate of Payment, a Change Order, or issue verbal instructions which modify the Contract between Owner and Contractor.

D. Responsibilities and Duties of Contractor:
   1. Performance or waiving of inspection, testing or surveillance by Testing Agency for a given portion of the Work will not relieve Contractor from responsibility to conform strictly to the requirements of the Contract Documents.

2. Access to Documents, Facilities and Materials: Furnish one copy of each accepted Shop Drawing and of each mill test certificate to Testing Agency. Provide reasonable office, desk and file space at each fabrication plant and at the site to allow Testing Agency to conveniently work with and to maintain project records and drawings. Provide authorized personnel convenient and free access to all parts, locations and areas of Work, including storage areas. Provide representative samples, coupons and the like as requested by Testing Agency. Provide hoisting, turning and moving of materials and reasonable quantities of scaffolding, power, casual labor, and other provisions and assistance necessary to allow quality and effective inspection and testing of Work.
3. Notice: Provide reasonable notice of the initiation of Work, including fabrication or erection requiring plant or jobsite testing or inspection.
4. Cost of Owner's Tests by Testing Agency will be borne by Owner. However, where additional tests are deemed necessary on account of failure to pass tests, the cost of additional testing will be deducted from payments to Contractor so as to reduce the Contract price.

E. One Shop Location is Assumed for purposes of this Contract. Where fabrication takes place in more than one shop, additional inspection costs resulting therefrom will be accomplished at Contractor's expense.

1.8 QUALITY ASSURANCE

A. Source Quality Control: Contractor's material control procedures shall be effective and shall assure that all Work fulfills the requirements of the project as well as the applicable provisions of the Contract Documents. All structural steel shall be identified and all material shall be tested in accord with the requirements of *Building Code*, of Building Department, of governmental authorities having jurisdiction and of this Specification.

B. Shop and Construction Site Quality Control: Contractor shall maintain, on staff, sufficient office, field engineering, and field supervision staff to assure that all data and layout drawings for Work of other Sections is transmitted to detailers to allow proper detailing of holes, penetrations, chases, and the like and to assure proper execution of the Work in the field.
1. Contractor's inspectors shall mark each weld or bolt inspected with an identifying mark. Such inspectors who provide inspections of poor quality shall be assigned to other projects or shall be retrained prior to reassignment to the Work.

C. Steel Fabricator: Fabricator shall have experience in the fabrication of structural steel for at least five (5) buildings of the type of this Work, and shall, within the last five (5) consecutive years, have successfully completed in a timely fashion at least two (2) projects similar in scope and type to the required work of this Section, and shall possess all capabilities and qualifications required for AISC Cbd (Complex Steel Buildings) Certification.

D. Steel Joist Fabricator shall be a member of the Steel Joist Institute, certified to fabricate those joist series required under the Contract Documents. Design of joists, bridging and accessories shall be attested in the Shop Drawings by the seal and the signature of a Professional Engineer licensed in the State of this project.

E. Steel Erector: The Erector performing the Work of this Section must, within the last five (5) consecutive years, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work for this Section.

F. Structural Steel Detailer: Should Contractor or the structural steel subcontractor elect to subcontract any portion of the steel detailing Work, the structural steel detailing firm shall be subject to acceptance. As a minimum requirement for acceptance, the structural detailing firm shall demonstrate experience in detailing of not less than five (5) buildings of the type of this work and shall demonstrate in-house quality control procedures to the satisfaction of Construction Manager and of Architect.
1. Acceptance of subcontract detailing firm is provisional and may be withdrawn where detailing is not of sufficient quality to meet project requirements.

G. Bolt Installation shall be in accord with the provisions of this Specification and in no case less than the best industry practice.
1. A qualified representative of the manufacturer shall be present for the start-up installation of each bolt type (DTI and/or TCF) used in the Work. For DTI's, a representative of the bolt manufacturer and a representative of the DTI manufacturer shall be present.
2. Contractor shall provide and shall maintain in good condition a Skidmore Wilhelm bolt tension calibrator (or other device accepted by Structural Engineer) at each location where high-strength bolts are being tensioned. Contractor shall test regularly:

a) each lot of structural fasteners (bolt, nut, DTI, washer and lubricant assemblies) before installation in the Work for the achievement of proper tension; and
b) the competence and understanding of bolting crews for each method of tensioning bolts for each size and grade employed in the work.

3. All members of bolting crews shall be fully instructed and experienced in the bolt tensioning system(s) employed in the Work.
   a) Each bolter, both shop and field, shall sign his own name immediately adjacent to each bolt group tensioned by that bolter. Such bolters who fail to follow proper procedures for snugging steel plies or fail to provide proper tension in bolts shall be retrained prior to reassignment to the Work or shall be removed from the Work.

H. Welding Procedure Qualification: Each welding procedure shall be described fully in a welding procedure specification and shall be designated prequalified under AWS D1.1 or shall be qualified in accord with provisions of AWS D1.1 and of *Building Code* prior to use in the Work.

I. Welder Qualification: Welders and welding operators performing work under this Section shall be qualified in accordance with *Building Code* and with applicable AWS requirements for each specific welding procedure and process which the welder will use in the Work.
   1. Contractor shall, when requested, require any welder to be retested; retesting, when requested, shall be performed with no additional compensation to Contractor.
   2. Welder, both shop and field, shall sign his own name immediately adjacent to each weld accomplished by that welder. Such welders who provide welds of poor quality shall be removed from the Work and shall be assigned to other projects or shall be retrained prior to reassignment to the Work.
      a) In addition to normal quality assurance testing by Contractor, all welds not signed shall be tested by Contractor by UT, MT or other appropriate method accepted by Structural Engineer.

J. Qualifications: Contractor shall determine, shall warrant and shall certify that producer, detailer, fabricator, erector, materials suppliers and all others involved in the Work, along with their personnel, are experienced, qualified and adequately staffed to undertake the specific Work required under this Section 05 10 00.

K. Post-Installed Anchors shall be installed by workers with experience and training with installing the specified anchors. Installation of adhesive anchors in horizontal or upwardly inclined orientations supporting tension load shall be performed by installers certified through the ACI/CRSI adhesive anchor installer certification program, or approved equivalent.

L. Documentation of Contract Conformance: Perform quality control functions required to achieve and to document that Work conforms to the Contract Documents. Provide access to Contractor's quality control documents and reports upon request. Provide reasonable numbers of photocopies of specific quality control reports on request.
   1. Contractor shall monitor initial fabrication and from time-to-time during the fabrication period, and shall inspect each delivery prior to loading for shipment. Contractor's monitoring and inspection shall assess the quality of fabricated material by visual inspections, checking of all material test reports, checking of all welding, bolting and other fabrication test reports and the evaluation of quality control procedures through which the fabricated material has passed.
   2. Contractor shall sample, test and report thereon each size and grade of high-tensile bolt, nut and washer. Such testing shall be accomplished for each lot of bolts received from each supplier and shall be accomplished prior to using in the Work. Tension testing (yield, ultimate strength, etc.) shall be carried out on full bolts, not on coupons.

M. Purchase Orders: Each purchase order shall identify the end use of the purchased material. Contractor shall ensure that manufacturer or vendor understands fully the intended use of the material in the Work. Provide manufacturers and vendors with a copy of this Section 05 10 00 of the Project Specifications.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials to be Installed Under Other Sections:
   1. Anchor bolts, embedded plates, anchorage devices, and other items required to be embedded in cast-in-place concrete shall be delivered to the project site at times coordinated by Contractor to allow convenient installation and orderly cast-in-place concrete operations.

2. Include setting drawings, templates, and directions for installation with all anchor bolts and with all other items or devices furnished and delivered to the project site for installation under other Sections of this Specification.

B. Storage of Materials:
1. Structural steel members and materials, whether or not fabricated, which are stored on or off the project site shall be supported above ground on platforms, skids or other supports. Where applicable, stacked members shall be separated by effective softeners. Storage methods shall protect steel members from overstress, permanent deformation and other damage.
2. Structural steel members and parts shall be protected from corrosion. Storage methods shall provide for free and rapid drainage of rainwater and shall prevent collection of water on or within stored members.
3. Materials shall be delivered to the site, ready for use, in the manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name, and manufacturer's name.
4. Packaged materials shall be stored under cover in dry, weathertight, adequately ventilated and clean locations off the ground. Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with accepted materials.
5. All fastener components shall be protected from dirt and moisture in closed containers at the site of installation. Only as many fastener components as are anticipated to be installed during the work shift shall be taken from *protected storage.* Fasteners components that are not incorporated into the Work shall be returned to *protected storage.* Fastener components shall not be cleaned or modified from the as-delivered condition.

C. Identification: Provide and maintain identification of all steels furnished to a specified minimum yield strength greater than 36 ksi (Grade 235) in accordance with *ASTM A6*.

D. Painted Steel:
1. Handling, Shipping and Erecting of shop painted steel pieces shall not be performed until the paint has dried thoroughly. Special care shall be taken to avoid abrasion or other damage to painted surfaces. Stacking and storing of painted members in the shop, in transit, and at the jobsite shall be done using appropriate softeners and timbers suitable to protect the paint from damage and to keep individual members free from contact with the ground and with each other.
2. Contractor shall furnish members in-place, fully painted, including all touch-up painting required as specified herein, at all locations where painting is required in the Drawings, by the provisions of this Specification, and by *Building Code*.

E. Cleaning: Subsequent to shipment and prior to erecting into the Work, Contractor shall clean steel to the extent required to allow full bond of paint or of fireproofing materials, as appropriate.

F. Delivered Materials shall be identical to accepted samples.

G. Removal: Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with acceptable materials.

1.10 JOB CONDITIONS

A. Contractor's Responsibility: Contractor shall be solely responsible for the correctness of dimensions and quantities and for the fitting to other Work; for Work to be confirmed and correlated at the site; for information pertaining to the fabrication procedure or to the means, methods, techniques, sequences and procedures of construction; and for the coordination of the Work of this Section with the Work of all other trades. The verification of the physical interrelationships of elements of the Work from Contract Documents and in the field is solely Contractor's responsibility. Review of Contractor's submissions does not relieve Contractor from these responsibilities.

B. Contractor's Coordination: Contractor shall coordinate and schedule the Work of this Section with the Work of other Sections of this Specification in order to optimize quality and to avoid delay in overall job progress.

C. Building Department Approval is required of fabricator. All fabrication shall be accomplished in a shop accepted by Building Department.

D. Rejection of Work: Testing Agency may inspect and test materials at the source before shipment as well as at the site before, during or after installation in the Work. Construction Manager and Architect reserve the right, at any time before final acceptance of the completed Work, to reject material not conforming with specified requirements, regardless of previous tests, inspections, acceptances, or inclusion in certificates of payment.

E. Provisions for Other Work: The Work under this Section shall include required cutting, punching, drilling, welding and all else required for the attachment and the passing-through of other Work.

F. Diagonal Bracing consisting of angles or tees shall be detailed short by 1/16 inch for each 10 feet of length, but with a maximum draw of 1/8 inch for tensile members, and 1/16 inch for compression members. Diagonal bracing shall be located on column centers unless shown specifically to the contrary in the Structural Drawings.

G. Construction Sequence: Descriptions of limitations on construction sequence are intended to assist Contractor in coordinating the Work of the Project. Descriptions do not describe fully the limitations given, do not describe all limitations, nor do they preclude construction sequences not contemplated herein. Whether or not Contractor follows the limitations on construction sequence described herein, and until such time as the structural work is completed, Contractor remains fully responsible for both the stability and the safety of the Work; adherence to the limitations described herein does not relieve Contractor from that responsibility.

1. Generally, the structure is to be constructed from the bottom to the top, floor-by-floor, with Contractor supplying such temporary bracing and shoring as may be required to compensate for the lack of completion of portions of the construction.
2. Plan and accomplish construction sequence in accord with Structural, Architectural, Mechanical, Electrical and all other Drawings forming a part of the Work.
3. Sealing of Erection Drawings by Contractor's Professional Engineer shall include and imply a full review of construction sequence and of related operations. Alternatively, Contractor shall submit a letter bearing the seal and signature of Contractor’s Professional Engineer attesting to conformance with this requirement.

H. Construction Loads: The structure is designed to resist safely the loading prescribed by *Building Code* for the finished building. No provision is included for loads or stresses imposed or induced by Contractor's means and methods of construction. Design loads are provided in *Building Code* but are sometimes modified upward as provided in Structural Engineer's Design Criteria.

1. Where Contractor elects to place loads on the structure or elects to otherwise load or deform the structure in excess of the design loads, Contractor shall submit drawings and supporting calculations prepared under the supervision of and sealed by Contractor's Professional Engineer.
   a) Review of Contractor's submittal shall not relieve Contractor from full responsibility for Contractor's means and methods of construction.
2. Alternatively, Contractor may seek professional services from Structural Engineer. Such services may be obtained through Owner or, with the permission of Owner, may be obtained directly from Structural Engineer. Architect will not be involved contractually in any such services.

I. Accidents and Hazardous Conditions: Contractor shall prepare a detailed written report of all accidents and other occurrences involving death, significant personal injury and/or significant losses in tangible property and shall submit the report promptly.

J. Installing and Rigging Equipment: Contractor shall shore all construction susceptible to impact loading from the installation of equipment installed by other trades.

1. Such equipment shall include but shall not be limited to boilers, chillers, refrigeration equipment, pumps, transformers, elevator machines and the like.
2. Remove shoring when equipment installation is complete.

1.11 DEFICIENT WORK

A. Repairing, Patching, Cleaning: Contractor shall correct all deficiencies in the Work of this Section 05 10 00, including areas where Testing Agency reports, or Construction Manager's or Architect's rejections have indicated that Work is not in full compliance with the Contract Documents. Perform, at no expense to Owner, all additional tests which Construction Manager or Architect deem necessary to reconfirm noncompliance of the original Work and perform, at no expense to Owner, all tests and inspections which may be necessary to show compliance of corrected Work.

B. Defective and Nonconforming Work: Defective Work, unsuitable Work or Work otherwise failing to conform to the Contract Documents shall be made good by Contractor at no change in the amount of the Contract. Contractor shall prepare appropriate details and procedures for bringing such Work into conformance with the Contract Documents and shall submit such details and procedures for acceptance. Corrective Work, including materials, shall conform strictly to accepted details and procedures. Nonconforming Work may be rejected at any time, regardless of prior acceptance in Shop Drawings, prior inspection, inclusion in inspection or test reports, or inclusion in certificates of payment.

C. Deficiencies: Where Work exhibits any one or more of the following Deficiencies, or where Work otherwise fails to conform to the requirements of the Contract Documents or to the requirements of *Building Code*, for any reason or combination of reasons, such Work shall be considered Deficient and not in conformance with the requirements of the Contract:
   1. Bent, twisted, buckled or warped pieces.
   2. Unauthorized cutting, reaming and so forth.
   3. Materials or workmanship not in accord with the Drawings, with the Specifications, with accepted samples, or with referenced codes or standards.
   4. Cracking, interior or surface defects and the like.
   5. Exceedance of tolerances.
   6. Painted, unpainted or galvanized surfaces not sufficiently clean to provide full bonding of spray fireproofing, paint or other coatings.
   7. Tops of flanges not sufficiently clean to receive field-applied stud shear connectors or deck welding.
   8. Post-installed anchors not set in accordance with Manufacturer’s Printed Installation Instructions, adhesive anchors not set with insufficient adhesive (no overfill visible).

D. Replacement or Repair: Where Construction Manager or Architect, at its sole discretion, finds any deficiencies or other Work not in accord with the requirements of the Drawings or with this Specification, Construction Manager or Architect may order that the affected Work be replaced or repaired at Contractor's expense.
   1. Contractor shall reimburse Owner for the actual amount of the fees of Testing Agency for the reinspection and the retesting of Work deemed defective by Construction Manager or by Architect.

E. Cost: The cost of all other activities and procedures associated with defective Work shall be paid by Contractor.

1.12 PROFESSIONAL FEES AND COSTS

A. Scope: Contractor shall compensate Architect, Structural Engineer and Architect's other consultants for services incurred because of Contractor-proposed deviations (including substitutions), extra submittals of Shop Drawings, deficient and defective Work and the like. Compensation will be at the rates given in the standard time-and-expense billing policy of the firm. Architect will notify both Owner and Contractor prior to the commencement of services associated with each item under this Article 1.12.

B. Deviations: Contractor-proposed Deviations will be evaluated and reviewed where requested by Contractor. This service includes the evaluation and review of substitute and alternative materials, products, systems, methods and the like.

C. Shop Drawings: The review of the first and the second submittals of each Shop Drawing are normal services, but the review of the third and all subsequent submittals of each Shop Drawing will be considered an extra service and subject to the compensation provisions of this Article 1.12.

D. Deficient Work: The evaluation, review and design and all other activities associated with Deficient Work are subject to the compensation provisions of this Article 1.12.

PART 2 PRODUCTS

2.1 GENERAL

A. Structural Steel furnished for each location shall provide the minimum yield point given in the Drawings, shall conform to the applicable ASTM Steel Specification, shall meet the requirements of *Building Code*, shall be suitable for use in welded structures and shall meet the requirements both of the Drawings and of this Specification. All material shall be new and of best commercial quality. Steels produced to modified ASTM Specifications shall not be used without written acceptance. Except where specific products are given in the Drawings or in this Specification, structural steel used in the Work may be chosen by Contractor from the applicable specifications listed in *AISC Specification* and accepted by both *Building Code* and by governing agencies having jurisdiction.

1. Contractor, in ordering materials from manufacturers and vendors, shall ensure that the manufacturer or vendor understands fully the intended use of the as-fabricated and as-erected Work. Provide manufacturers and vendors with a full copy of this Section 05 10 00. Purchase orders shall identify the end use of purchased materials.
2. Unless noted specifically as not carrying tensile loads or detailed as bolted, all steels and products selected for use in the Work shall be suitable for use as tension members, connected by welding.

2.2 MATERIALS

A. Welding Materials shall be as required by *Building Code* and by AWS for the conditions of intended use and for the metal being welded. Provide welding materials with as-welded Charpy V-Notch impact values of not less than 20 ft-lb at 0°F. Welding materials shall conform to the base metal/filler metal combinations listed in the AWS Specifications and Table 2.2-1 and to the filler metal classifications listed in Table 2.2-2, except where other welding material or material combinations and related welding processes are accepted.

TABLE 2.2-1				
Base Metal Yield	**Filler Metal Classifications**			
	SMAW	**SAW**	**GMAW**	**FCAW**
Up to & Incl. 50 ksi	E70 (E480)	F7 (F48)	ER70 (ER480)	E7 (E48)
60 ksi & 65 ksi	E80 (E550)	F8 (F55)	ER80 (ER550)	E8 (E55)
70 ksi & greater	E90 (E620)	F9 (F62)	ER90 (ER620)	E9 (E62)

TABLE 2.2-2				
Base Metal	**Welding Process**	**AWS Spec.**	**Filler Metal Classification**	
Carbon Steel and Low Alloy Steel	SMAW	A5.1	E7018	
		A5.5	E8018-C3, E9018-D3	
	SAW	A5.17	F7A2-EXXX	
		A5.23	F8A2-EXXX, F9A4-EXXX	
	GMAW	A5.18	ER70S-6, ER70S-2	
		A5.28	ER80S-D2, ER90S-D2	
	FCAW	A5.20	E71T-8, E71T-1, E70T-1, E70T-6	
		A5.29	E71T-8Ni1, E81T1-Ni1, E91T1-Ni2	
Stainless Steel			**(Type 304)**	**(Type 316)**
	SMAW	A5.4	E308L	E316L
	SAW	A5.9	ER308L	ER316L
	GMAW	A5.9	ER308LSi	ER316LSi
	FCAW	A5.22	E308LT	E316LT
Stainless Steel to Carbon Steel	SMAW	A5.4	E309L	
	SAW	A5.9	ER309L	
	GMAW	A5.9	ER309LSi	
	FCAW	A5.22	E309LT	

Welding electrodes which have been dampened or which have been contaminated by grease or other substances deleterious to welding shall not be used in the Work.

B. Shielding Gas shall be of a welding grade having a dew point of -40°F (-40°C) or lower.

C. Stud Shear Connectors: Material and equipment for welded studs and stud shear connectors shall conform to *Building Code*, to AWS D1.1 and to applicable portions of Section 05 30 00 "Metal Deck and Stud Shear Connectors". Material shall conform to AWS D1.1, Chapter 7, Type B and to ASTM A108, Grade 1015 or 1020, cold finished carbon steel, with dimensions conforming to AISC Specification. Accepted manufacturers are the Nelson Stud Welding Division of TRW, Midwest Fasteners, or other accepted manufacturer.

D. Deformed Bar Anchors shall be ASTM A496 deformed bars prepared for stud welding in accordance with AWS D1.1. Material shall conform to AWS D1.1, Chapter 7, Type C. Accepted manufacturer is the Nelson Stud Welding Division of TRW or other accepted manufacturer. Provide ½ inch diameter, 36 inch long bars, unless otherwise given in drawings.

E. High Tensile Bolts, Tension Control Fasteners, Nuts, DTI's and Washers shall conform to the applicable ASTM specification shown in Table 2.2-3.

TABLE 2.2-3			
Bolts	**Nuts**	**DTI's**	**Washers**
ASTM A325 (Type 1), ASTM F1852 (TCF), and ASTM A490 (Type 1)	ASTM A563 (DH)	ASTM F959	ASTM F436

NOTE: Neither A490 Type 2, A490 Type 3, nor A325 Type 3 shall be used in the work.

All fastener components shall bear the manufacturer's mark; nuts shall bear the DH symbol. Sleeve nuts, clevises and the like shall develop the full strength of the threaded rod or bolt. All bolts, nuts and washers shall be cold forged; bolts shall have rolled threads. Neither hot forged bolts or nuts nor cut threads may be used in the Work.

1. In addition to the mandatory testing provided in the ASTM specification, proof load testing (ASTM F606), chemical analysis (ASTM A751) and certification shall be required of manufacturer; for galvanized bolts, nuts and washers, manufacturer's certification shall include the results of the rotational-capacity tests as well as the results of the zinc thickness measurements. Except for the rotational-capacity tests of galvanized bolt, nut and washer assemblies, which shall be performed in accord with the Shipping Lot Method, all testing and analysis shall be conducted in accord with the Production Lot Method. Testing shall be completed for each grade of each type of each size of fastener. Fastener components not in full conformance to the appropriate ASTM specification shall not be shipped to the Work.
   a) Proof load testing shall be conducted on full-size bolts and components not on machined test specimens.
   b) Proof load testing shall be accomplished using Method 1 (Length Measurement) of Method F606.
   c) Testing shall include both hardness and tensile strength.
2. Bolts, nuts and washers shall be manufactured by a member of the Industrial Fasteners Institute.
3. Accepted manufacturers are:
   a) LeJeune Bolt Company
   b) Infasco
   c) Nucor Fastener
   d) Unytite
   e) Lohr Structural Fastener
   f) Other where accepted.
4. Mechanical galvanized bolts, nuts, washers, DTI's and inserts, as applicable, conforming to ASTM B695, Class 50 shall be used at all surfaces containing galvanized materials and at all surfaces exposed to ambient temperature. Galvanizing shall be undertaken only on A325, Type 1 bolts, ASTM A563 DH nuts, ASTM F959 DTI's, and F436 heat treated washers. ASTM F1852 tension control fasteners shall not be galvanized by any process.
5. Beveled washers shall be square, smooth, and shall be sloped to provide contact surfaces in full bearing. Provide for all slopes of 1:20 and larger.
6. The diameter of holes in special, beveled and square washers shall not exceed 1/16" more than the nominal bolt diameter.
7. Thread Lubrication shall conform to bolt manufacturer's written recommendation. All galvanized A563 nuts shall be provided with an additional lubricant that shall be clean and dry to the touch and have a color that contrasts with the zinc coating so its presence is visually obvious. Galvanized structural bolts shall be Rotational Capacity Tested in accordance with the provisions of ASTM A325, and a record of such tests for each lot shall be submitted to the Structural Engineer

F. Bolt Tension Indicating Devices shall be direct-tension indicating washers (DTI) or tension control fasteners (TCF).
   1. Direct-tension indicating washers shall be of domestic manufacture, containing only domestically produced raw materials, conforming to the latest revision of ASTM F959. No 'squirt-type' DTI's are to be used, nor DTI's with slots cut in the back. Accepted manufacturers are TurnaSure LLC, Bethfast Inc., or other where accepted. Provide mechanically galvanized (ASTM B695, Class 50) washers for all surfaces and assemblies containing galvanized materials.
   2. Tension control fasteners shall conform to the latest revision of ASTM F1852 for the A325 strength level, and to the applicable provisions of ASTM A490 Type I as well as the provisions of Section 2.8 of the RCSC Specification pertaining to Alternative-Design Fasteners. Accepted manufacturers are LeJeune Bolt Company, Infasco, Vermont Fasteners Manufacturing, or other where accepted.
      a) Neither A490 Type 2, A490 Type 3 nor A325 Type 3 shall be used in the Work.

G. Anchor Bolts: May be of uncoated steel unless otherwise required by the Drawings, by *Building Code* or by governmental authorities having jurisdiction. Unless otherwise provided in the Drawings provide 1 inch diameter or larger.
   1. Unless otherwise given, provide as follows:
      a) Bolt material conforming to ASTM F1554 FY 55.
      b) Two heavy hex nuts as specified for *ASTM A325*.
      c) 3 x 3 x 3/8, FY 50 plate washer.

H. Post-Installed Mechanical Anchors shall be either expansion or undercut type. Where substitutions are requested, the alternate anchor shall be similar in type to the specified in the Contract Documents and be designed in accordance with substitution requirements.
   1. Standard Wedge-Type Expansion Anchors:
      a) Kwik Bolt TZ-2, by Hilti Corp.
      b) Power-Stud+ SD1 and SD2, by Power Fasteners Inc.
      c) Other where accepted
   2. Galvanizing shall conform to ASTM B695, Class 50 or to ASTM B633, SC1.
   3. Stainless steel for studs and washers shall conform to AISI Grade 304 or Grade 316 and to ASTM F593, Group 1 or Group 2, Condition SH. Nuts shall be of stainless steel conforming to ASTM F594, Group 1 or Group 2, Condition SH.

I. Post-Installed Adhesive Anchors shall be either acrylic epoxy, injectable type. Where substitutions are requested, the alternate adhesive shall be similar in type to that specified in the Contract Documents and be designed in accordance with substitution requirements.
   1. Acrylic Adhesive:
      a) HY200, by Hilti Corp.
      b) AC100+ Gold, by Powers Fasteners Inc.
      c) Other where accepted
   2. Epoxy Adhesive:
      a) Hilti RE 500 V3, by Hilti Corp.
      b) PE1000+, by Powers Fasteners Inc.
      c) Other where accepted
   3. Galvanizing shall conform to ASTM B695, Class 50 or to ASTM B633, SC1.
   4. Stainless steel for studs and washers shall conform to AISI Grade 304 or Grade 316 and to ASTM F593, Group 1 or Group 2, Condition SH. Nuts shall be of stainless steel conforming to ASTM F594, Group 1 or Group 2, Condition SH.

J. Thread Locking Compound shall be Loc-Tite 242 or 243, as appropriate, by Loctite Corporation, or other accepted compound.

K. Steel Deck Support Shelves: Provide angles of 5/16 inch minimum thickness and 3 inch minimum width except where different shapes or dimensions are accepted.

L. Gratings, treads, and planks shall be proportioned to resist safely the superimposed loads.
   1. For pedestrian loading provide skid resistant, galvanized grating/treads/planks proportioned to carry safely a live load of not less than 100 psf.

M. Shop and Field-Applied Paint shall be provided where designated in the Drawings, specified herein, and where required by *Building Code*. Paint materials shall be fully compatible with fireproofing and other materials in contact with the paint and shall be selected from the following:
   1. Alkyd Modified Shop Primer and Field Touch-Up:
      a) Carbocoat 150 Primer, by Carboline Inc.
      b) Dulux Alkyd Primer 681-FD, by DuPont Co.
      c) Tnemec Primer 10-99, by Tnemec Company Inc.
      d) Other where accepted
   2. Zinc-Rich Shop Primer:
      a) Carbozinc 11 HS or Carbozinc 859, by Carboline Inc.
      b) Ganicin 347-Y-931, by DuPont Co.
      c) Tneme-Zinc 90-96 or Tneme-Zinc 90-97, by Tnemec Company Inc.
      d) Other where accepted
   3. Zinc-Rich Field Touch-Up:
      a) Carbozinc 859, by Carboline Inc.
      b) Ganicin 347-Y-937, by DuPont Co.
      c) Tneme-Zinc 90-97 by Tnemec Company Inc.
      d) Other where accepted
   4. Where aluminum alloy is in contact with or fastened to steel members, the aluminum shall be kept from direct contact with the steel by painting the steel with a dielectric separator such as Bitumastic 50 by Carboline Inc., or other where accepted.
   5. Fusion Bonded Epoxy Coating shall conform to ASTM A775. Acceptable manufacturer is Scotch Kote 413 by 3M, or other where accepted.

N. Galvanized Steel: Where required to be galvanized, members shall be hot-dipped after fabrication in accordance with ASTM A123 or with ASTM A153, as applicable. Galvanizing shall equal or exceed 2 oz. per square foot (600 g/m^2) of surface.

O. Galvanizing Repair Paint: Provide organic, zinc-rich paint that contains at least 90% zinc particles in the dried film. Galvanizing paint shall comply with either ASTM A-780, Federal Specification DOD-P-21035 or Military Specification MIL-P-26915.
   1. Brite Zinc, by Brite Products
   2. ZIRP, by Duncan Galvanizing Corp.
   3. ZRC Cold Galvanizing Compound, by ZRC Products Company
   4. Other where accepted

P. Weldable Primer shall be used for the protection of beveled surfaces to be complete penetration or partial penetration welded in the field. Weldable primer is also acceptable for the protection of milled surfaces used in bearing connections. Acceptable primers are CarboWeld 11 HS by Carboline, Deoxalumite by AACO, or other accepted weldable primer.

Q. Milled Surfaces: Coat with Multi-Bond 120 (Carbo-Crylic), by Carboline Inc., or other accepted rust-inhibitive coating.

R. Body Putty shall be Premiere Plus Tack free lightweight auto body filler by U.S. Chemical & Plastics or other accepted Body Putty.

PART 3 EXECUTION

3.1 CONTRACTOR'S INSPECTION

A. Examination of Field Conditions: Examine all surfaces, features and facilities to which Work must be attached or applied, abut or clear. Notify Construction Manager and Architect in writing of all conditions which are or will be detrimental to proper and expeditious installation of Work. Starting of Work shall represent acceptance by Contractor of surfaces and of conditions as suitable and correct for performing Work as specified.

B. Field Measurements: Contractor shall verify, by measurements at the jobsite, all dimensions affecting the Work of this Section. Field dimensions at variance with those in accepted Shop Drawings shall be reported in writing by Contractor. Decisions regarding corrective measures shall be subject to acceptance and acceptance shall be obtained before starting fabrication of items affected. The starting of Work shall represent acceptance by Contractor of all dimensions affecting the Work of this Section as suitable and correct for the performing of all Work under this Section.

3.2 FABRICATION

A. Structural Steel shall be shop fabricated in strict accord with Shop Drawings, certificates, and other accepted data. All Work shall conform to the applicable Standard as given herein and as need apply to the Work. Workmanship shall be of the best practice of relevant trades and shall be performed by skilled mechanics making use of modern tools and equipment in good condition. To the extent practical, Work shall be accomplished in the shop and not in the field.

B. Material Delivery Tolerances: While ASTM A6 and A20 are acceptable delivery tolerances for mill material, Contractor shall straighten, square, flatten and torsionally align plates and shapes as necessary to provide fabricated elements within allowable tolerances as well as to provide correct alignment, good fit and uniform erection clearance, as applicable.

C. Cleaning and Straightening: Prior to fabrication or Work, all steel shall be examined for confirmation to the delivery tolerances. All out-of-tolerance conditions shall be corrected prior to fabrication by making use of techniques accepted under this Specification. Steel shall then be cleaned by blasting and/or wire brushed so as to remove all loose mill, scale and rust.

D. Camber and Sweep: Except where specific camber or sweep is designated in the Drawings, beams shall be fabricated with natural camber up. Provide spandrels and beams adjacent to openings with the natural sweep inward (toward the building and away from immediately adjacent openings). Designated camber shall provide actual camber in the erected steelwork within camber tolerances set forth in AISC Manual (for rolled shapes) and in AWS D1.1, Chapter 5.23 (for built-up shapes).

1. Camber trusses to compensate for truss deflection due to weight of supported construction, thereby providing top of truss, after completion of Work, at elevations designated in the Drawings.

E. Finishing shall mean milled to ASA 250 or smoother, unless another finishing method is both designated in Shop Drawings and accepted. Finished surfaces shall be protected by a corrosion inhibiting substance. Finish contact surfaces of grillages, base plates, column splices, where indicated "fit to bear", and at other locations where indicated in Drawings.

F. Gas Cutting: Gas cutting, including miscellaneous cuts, copes, cuts for weld access and the like, shall provide smooth, uniform, workmanlike surfaces and shall achieve a 1000 micron surface roughness or better as defined by ANSI/ASME B46.1. Except where accepted, gas cutting shall be machine guided; cutting by hand-guided tools will require grinding. Provide 1/2 inch minimum radius cut at all reentrant corners except where a smaller or larger radius for specific details is shown or noted in the Drawings or specifically proposed by Contractor and accepted in Shop Drawings. Gas cut surfaces shall be made uniform and notch-free by chipping, planing, welding and grinding as required, and shall be verified by Contractor by full visual inspection; where hand-held cutting tools are used, and where required by *AISC Specification*, Contractor shall provide 100% inspection by liquid-penetrant or by magnetic particle.

1. Galvanized Members: Gas-cut surfaces at reentrant corners shall be ground to bright metal and tested by dye-penetrant or magnetic particle testing prior to galvanizing, and shall be verified by Contractor by full visual inspection after galvanizing.

G. Straightening: Fabricated materials containing sharp kinks or bends shall be rejected. Material straightened prior to fabrication shall be examined carefully for signs of distress and for other defects before being placed in fabrication. Distressed or otherwise defective material shall not be used in the Work. Straightening by the use of properly controlled heat will be permissible if done by personnel skilled in heat straightening, using equipment and techniques in accord with written procedure documents and applicable detail sketches prepared by the Fabricator and accepted.
   1. Follow procedures provided under AWS D1.1.
   2. Fuel shall be propane and oxygen.
   3. Temperature may not exceed 1200°F - a dull red color - or limits specified for quench and tempered steels, as applicable.
      a) Control with Tempilstick or Thermomelt Stick for 1000°F to 1200°F range.
      b) Single burner torches shall be used.
   4. Air cool at ambient temperature.
      a) Water cooling shall be used only with written permission.
   5. All welds in straightened material shall be reinspected by Contractor, by UT or MT as appropriate.

H. Grinding: Sharp corners, projections, and similar rough or sharp surfaces or edges shall be eased and smoothed by grinding so as to provide notch-free surfaces.

I. Preheat: Welding shall be performed on material preheated to a temperature above the dewpoint, regardless of other preheating requirements. Preheat for welding shall be soaked preheat and shall be verified by heat sensitive crayons (Tempilstik, by Tempil, Inc.) or other accepted means.

J. Welding Materials and processes shall be selected from those specified herein and shall conform to accepted welding procedure specifications. Welding materials shall be fresh and new. Welding electrodes or flux contaminated by deleterious substances or moisture shall not be used and shall be removed promptly from the Work. Low hydrogen electrodes which cannot be used promptly after opening of hermetically sealed containers shall be stored in electric holding ovens at 250°F (120°C) minimum. Electrodes or flux which have been dampened or contaminated shall be removed promptly from the Work.

K. Tack Welds: Exercise the same degree of control in making tack welds as required for structural welds, including provision of preheat and postheat appropriate to the basemetals joined. Tack welds which crack shall be cut or ground and damaged base metal repaired. Remove and grind smooth tack welds not incorporated into permanent structural welds.

L. Arc Strikes: Stray arcing between electrodes or other portions of the welding system and base metal locations outside structural welds shall be avoided to the maximum extent practicable. In those locations where arc strikes do occur, the affected base metal shall be ground smooth, or otherwise repaired, to remove the effects of the arc strike and ensure continuing soundness of the base metal.

M. Shop Bolting with ASTM A325 or ASTM A490 bolts shall conform to applicable provisions of the *AISC Specification* and *Specification for Structural Joints Using ASTM A325 or* A490 *Bolts* except that all bolting provisions set forth in ERECTION of this Section shall apply to high-strength shop bolting.

N. Drainage Holes: Provide hollow tubular, box and other members with effective drainage holes except where members are sealed tight at Contractor's option or in accord with notes and details included in the Drawings. Structural Steel Sub-Contractor is fully responsible to provide steelwork free of entrapped water at the completion of the project.

O. Beam Openings: Provide openings as shown, noted or scheduled in the Drawings. Provide holes, slots and openings required for passage of Work of other trades together with necessary reinforcing. Use suitable templates for accurate location of openings. Where openings are shown in the Drawings or in Shop Drawings, changes in location will not be permitted except where accepted specifically. Beam openings not shown or scheduled shall be provided only where accepted specifically.

P. Steel Deck Support Material shall be shop welded to structural steel except where field welding is necessary to provide required erection sequences.

Q. Bolt Holes: Drill or punch holes at right angles to the surface of the metal. Provide holes not more than 1/16 inch (1500 ⍰m) larger than the connector diameter unless oversize or slotted holes are shown or noted in the Drawings or specifically accepted. Do not make or enlarge holes by burning. Drill or sub-punch and ream material where thickness exceeds the connector diameter and in all material thicker than 7/8 inch. Holes shall be true and fair without torn or ragged edges. Elongated punch and die sets shall be used to punch elongated holes. Burrs shall be removed.

R. Quality of Welds and Base Metal: Quality of all welds shall conform to AWS D1.1, Chapter 6 - Part C. When examined by UT, partial and complete penetration welds shall conform to AWS D1.1, Chapter 6 statically loaded acceptance criteria. Unless otherwise noted, welds shall be assumed to be subjected to tension stress normal to the weld axis. Cracking or incomplete penetration shall be cause for rejection of each weld possessing such defects, regardless of other acceptance or rejection criteria. Base metal containing gross discontinuities before or after welding or lamellar tearing after welding shall be repaired in accord with procedures accepted by Structural Engineer or shall be discarded and replaced.

1. Provide material thickness and width transitions in accord with details in the Drawings where shown, and in accord with the provisions of AWS D1.1, Article 2.29.
2. Provide weld access holes or cuts in accord with details shown in the Drawings, the provisions of AWS D1.1, the provisions of the *AISC Specification* and the gas cutting provisions of this Specification. Plug access holes with defect-free base metal and weld metal where sealed members are required.

S. Stud Shear Connectors and Deformed Bar Anchors: Prepare structural steel surfaces as recommended by the stud manufacturer. Use automatic stud welding systems and use such systems in strict accord with the manufacturer's printed instructions. All welding ferrules shall be broken and shall be removed from the Work. Fillet welding shall be used for repair welding only. Arc weld repairs to stud welds shall be made to the extent required by AWS D1.1, Chapter 7. Conform to applicable provisions of Section 05 30 00.

1. Where indicated in the Drawings, bend deformed bar anchors in accordance with the Drawings and with this Specification:
   a) Before automatic stud welding, cold bend deformed bar anchors as required in accordance with the bend requirements given in the Contract Documents for concrete reinforcing bars of the same diameter. The use of heat to either bend or straighten deformed bar anchors is not permitted.
   b) Once bent, the shop straightening of either deformed bar anchors is not permitted. The field straightening of bars that have been embedded in concrete is not permitted except where accepted specifically.

T. Brittle Fracture Contractor shall take all measures necessary to minimize the occurrence of brittle fracture. Measures shall include proper materials selection, fabrication techniques and the like.

1. Both base metal and welding materials shall provide adequate notch toughness.
2. Stress concentrations shall be minimized by carefully controlling notches and by controlling weld defects such as lack of fusion and cold cracking. Stress relief holes shall be provided at all welded web-to-flange interfaces for shapes with flange thickness in excess of 1.0 inches.
3. Welds, including multiple-pass welds shall be completed in a single operation, without interruption.
4. Cooling rates and non-uniformity of cooling of welds shall be reduced by proper insulating blankets and, where necessary, by post-heating.
5. Excessive elevation of welding temperatures shall be avoided. Practices such as the simultaneous welding of both sides of a stiffener within the bosom of a wide flange shape shall not be allowed.
6. Provide and then remove run-on and run-off tabs at all locations where start-up or termination portion of weld may create a stress raiser.
7. Particular care shall be taken to eliminate cold cracking.
   a) Pre-heat and post-heat conditions shall be provided not less than as required per AWS D1.1.
   b) Welding electrodes are assumed to be of the low hydrogen type, thoroughly baked, and that rust and oil in welding grooves is not present. Note that sufficient pre-heating, with lower heating rate and wider pre-heated zone is required in order to keep interpass temperatures above minimum values, particularly where heavier sections are being welded.
   c) Weld cooling rate shall be controlled so as to reduce residual stresses caused by welding and to enhance hydrogen evolution.
   d) Welding at ambient temperatures below 32°F (0°C) shall not be accomplished without prior acceptance.
8. Take special care to grind copes, access holes and other cuts so as to improve the surface and to reduce the potential for notch formation.

U. Weld Inspection: Contractor shall inspect 100% of shop and field welds to assure that all welding conforms to the requirements of Contract Documents. Governing documents include, but are not limited to this Specification, Contract Drawings, *Building Code* and ANSI/AWS D1.1, D1.3, and D1.4. All inspections shall assume that welds are in tension, with direction of stress in most critical direction (for example, transverse to undercut).

V. Runon and Runoff Tabs shall be removed and the surface made smooth prior to visual and non-destructive testing and prior to shipping Work to the site. Tabs for field welds shall be removed at all locations where required or directed.

W. Clean, Paint and Galvanize steel as provided herein. Do not paint steel except where provided specifically herein or in the Drawings.

X. Weep Holes: Where open members (such as wide flange shapes or channels) are positioned on their sides with flanges up, capable of holding water, provide weep holes as shown in the drawings or as specified. Unless otherwise noted, provide 1/2 inch diameter weep holes at 10 feet o.c., but not less than three 1/2 inch diameter weep holes per piece: one weep hole at each end, and one at midspan.

3.3 ERECTION

A. Erection of steelwork shall be performed by skilled workers in accord with the accepted Shop Drawings and certificates and shall conform strictly to the Contract Documents.

B. Surveys: Contractor shall employ a Professional Engineer or Professional Surveyor licensed in the project's jurisdiction and experienced in surveying steel building frameworks to oversee all survey work. Contractor shall organize structural steel surveying procedures and records to demonstrate the degree of conformance of the steelwork to tolerances applicable to plumb, level, horizontal alignment and allowable displacement from theoretical elevation. Contractor shall report all discrepancies. Contractor shall not proceed with each erection step until appropriate acceptable corrections have been made, or until compensating adjustments to the structural steelwork have been accepted. Contractor's surveys for steelwork shall:
   1. Establish permanent bench marks as shown and as necessary for the accurate erection of structural steel;
   2. Assure that elevations of bearing surfaces, and locations of anchor devices are checked by accurate surveying before erection work proceeds.
   3. Provide survey data during the course of the Work and a final survey showing the E-W, N-S and elevation position of the work points of each steel frame, truss, column and other major member as compared to theoretical location.
   4. Take surveys and measure tolerances and plumbness at 68°F (20°C) or show corrections to surveys where temperature is either higher or lower.

C. Anchor Bolts and Other Connectors: Furnish anchor bolts, embedded plates and other connection materials which must be embedded into concrete Work, for placement under Section 03 30 00. Deliver to the site on-time and complete with templates and placing drawings. Tighten nuts in a manner consistent with the intent and the metallurgy of the bolt material.
   1. Unless otherwise provided, for bolts designated as A325 or Dywidag threadbars, tighten 1/4 turn past snug tight.

D. Base Plates and Bearing Plates: Furnish and place base plates and bearing plates accurately. Securely shim, level and align. Be responsible for maintaining steel in proper position through completion of grouting and until grout has achieved full strength. Non-shrink grout will be furnished and placed under Section 03 30 00. Do not allow grouting until beams, girders, trusses and so forth are permanently attached to column.

E. Guying and Bracing: The structural system may require temporary bracing in addition to members shown in the Drawings in order to resist safely all imposed loads during construction and to maintain correct alignment. Provide temporary guying, bracing and connecting members where needed to resist safely all possible combinations of construction and erection loads including dead loads, erection loads, wind and other lateral loads and superimposed construction loads, both horizontal and vertical. Remove temporary members and connections after permanent members are in place, final connections are made and concrete has achieved design strength. Design of temporary shoring, bracing and guying is Contractor's sole and complete responsibility, including all details of installation and removal, methods, sequence and timing. Contractor's Professional Engineer shall design and supervise the adequacy, installation and removal of temporary bracing.

F. Bolt Tensioning: ASTM A325 and A490 bolts shall be tension controlled fasteners with splined twist-off nubs (TCF) installed in accord with *AISC Specification* requirements and with applicable printed instructions and recommendations provided by the fastener manufacturer and tensioning system supplier. To provide uniform and full tensioning in multi-bolt joints, bolts shall be tightened in stages to assure uniform contact between faying surfaces and snug-tight condition at all points within each joint prior to final tensioning and shearing of the spline. Contractor shall check each TCF bolt after tensioning to verify that the sheared surface does not display any abnormality. Bolts displaying an abnormality shall be removed and replaced.

G. Bolting Requirements: Contractor shall pay strict attention to the applicable codes and standards, to the requirements of this Specification and to the following general requirements:

1. Impact Wrenches used for tightening ASTM A325 and ASTM A490 bolts shall be in sufficiently good repair to dependably deliver the manufacturer's full rated torque. Air compressor(s) used to power impact wrenches shall be in good repair and shall be capable of delivering adequate air pressure and volume so that full rated performance is achieved from each wrench at the point of bolting. Air hoses and couplings shall be non-leaking. The impact wrench(es) selected shall tighten the bolts to not less than the minimum specified tension in thirty seconds or less.
   a) For bolt sizes equal to or larger than 1 inch ASTM A325 and 7/8 inch A490, provide impact wrenches equivalent to or larger in capacity than a Chicago Pneumatic CP6120, with air pressure at the wrench not less than 100 psi (700 kPa).
2. Washers: A hardened washer shall be installed adjacent to the bearing face of the turned element (nut or bolt head) of each ASTM A325 or ASTM A490 bolt assembly. A 5/16 inch thick washer or thicker, otherwise conforming to ASTM F436, shall be used at both ends of 1-1/8 inch and 1-1/4 inch diameter A490 bolts connecting material with standard size holes where material is 5/8 inch or less in thickness.
3. Long Slotted Holes, where accepted, and where on an outside ply, shall be covered completely by 5/16 inch ASTM F436 hardened washers; alternatively, either plate washers or continuous bars of at least 3/8 inch thickness and minimum yield point of Fy = 50 ksi may be used. Holes in plate washers or bars shall be standard size. Regular hardened washers are required in addition to plate washers or bars.
4. Short Slotted and Oversized Holes, where accepted, and where on an outside ply, shall be covered by ASTM F436 hardened washers, plate washers or continuous bars as provided for long slotted holes.
5. Bolts and Nuts, at time of tightening, shall be clean, rust-free, free from thread damage, and shall retain not less than the light residual coating of oil as received from the factory. Thread lubricants shall be applied to all ASTM A490 bolts or nuts, to all 1 inch and larger ASTM A325 bolts and to all bolts and nuts that display any sign of loss of residual oil, rust or other contaminant. Where galvanized nuts are not wax-dipped by manufacturer, apply thread lubricant.
   a) Lubrication shall be completed prior to assembly and prior to being sent up into the Work, except that under no circumstance shall twist-off type tension-control fasteners be field lubricated.
   b) In the event of a dispute regarding tightness of bolts installed in the field, cleanliness and lubrication of bolts and nuts used for verification tests shall be specifically representative of field materials and conditions.
6. Tightening Procedures: During tightening, to the full extent practical, the unturned bolt element shall be held without rotation. All plies shall first be brought into full contact by partially tensioning all of the bolts. Tensioning shall commence from the most rigid part of the connection, moving to the free edges.
7. Retightening: ASTM A490 bolts and galvanized ASTM A325 bolts, once completely or partially tensioned, shall not be reused. ASTM A325 bolts may be reused only with specific written acceptance.
8. Length: Bolts shall not project beyond the face of the nut by more than three full threads. However, bolts shall at least be flush with the other face of the nut.

H. Unfair Holes shall not be enlarged by burning or drifting alone. Enlarge holes where necessary and permitted by flame piercing and reaming or by reaming alone or by other accepted means. Holes after enlargement shall be true round holes normal to the surfaces joined. Increase bolt size to fill enlarged and reamed holes, which shall then meet the requirements for “normal-sized” holes relative to the bolt size selected.

I. Faying Surfaces: Paint materials not specified as satisfying the mean slip coefficient for Class A surfaces as defined in the S*pecification for Structural Joints Using ASTM A325 or A490 Bolts* shall not be applied to faying surfaces.

J. Field Welding shall be performed only by properly licensed and certified welders. Welders shall wear on their helmets labels showing their AWS Qualification Number and shall carry at all times AWS identification/ certification cards. Pay strict attention to the need for welder to sign his/her name near welds which they have made. All welding provisions set forth in FABRICATION of this Section shall apply to field welding. Field welding shall be performed in accord with accepted procedure specifications. Field welds shall be subject to the same acceptance criteria as shop welds. Do not weld over a shop weld in the field unless the field weld is made with the same electrode and the same weld procedure as used in the shop.

K. Splices: Column splices and other compression joints that depend upon contact bearing after alignment shall conform with the following:
   1. Bearing surfaces shall be cleaned before the parts are assembled.
   2. Fastening of compression splices and joints shall be performed after the abutting surfaces have been brought uniformly into contact.

L. Permanent Connections: Structural members shall be permanently attached and made rigid only after all elements to be attached have been brought within the specified tolerances.

M. Field Fabrication, gas cutting and welding work shall conform to the applicable provisions of FABRICATION of this Section. Bent, kinked or deformed members may be rejected by Architect at its sole discretion. Such members may be straightened and corrected only in accord with accepted procedures. Gas cutting shall occur only where the metal being cut is not carrying stress, and provided stresses will not later be carried through a flame-cut surface.

N. Finger Tight: Bolts designated as "finger tight" shall be tensioned to 60 inch-pounds (6 N-m) with the goals of bringing the parts firmly together while allowing for a sliding connection. Provide thread locking compound at all such locations. Provide not less than two full cycles of torquing and untorquing to ensure that all bolts are properly tensioned.

O. Tolerances: Do not exceed tolerances provided under this Specification, *AISC Code*, *AISC Specification*, and AWS D1.1.

P. Shims, where required to correct fit-up of Work, shall be free of corrosion and shall be of stainless steel.

Q. Runoff and Runon Tabs shall be provided at the ends of all sensitive butt welds and both tabs and erection aids shall be removed at all locations where they interfere with the Work of other trades, and at all locations designated. Runoff tabs shall be not less than 1-1/4 inches in length.

R. Post-Installed Anchors shown in the Drawings, or accepted in writing, shall be installed in strict accord with Manufacturer’s Printed Installation Instructions. Set perpendicular to concrete surface. Anchors may be placed in block or brick work only where voids within 9 inches of the anchor have been filled solidly, with grout. Drilled holes shall be cleaned thoroughly by compressed air or water jet. Holes in structural steel, intended to fit over post-installed anchors, shall be 1/16th inch larger than the nominal diameter of the bolt except where larger or smaller holes are stipulated in the Drawings. Provide standard plate washer underneath Anchor Manufacturer’s provided washer.

S. Lock Nuts or Thread Locking Compound shall be used on all nuts not tensioned in accord with the specifications for ASTM A325 or ASTM A490 bolts and on all ASTM A307 bolts. Provide thread locking compound on A325 and A490 bolts only where allowed specifically in the Drawings; at other locations, use locking nuts as specified herein.

3.4 CLEANING, PAINTING AND GALVANIZING

A. General: Steel Work shall be cleaned, painted and/or galvanized as provided herein. Basic Work shall be done in the shop, with field touch-up, only, done in the field.

B. Corrosion Protection: Steel which is exposed to the weather, including exterior lintels, shall be hot-dipped galvanized. Touch-up at welds and at damaged surfaces after first cleaning to SSPC-SP3, with slag and weld spatter removed first from all areas. Paint galvanized steel where shown in Drawings.
   a) Provide galvanized bolts, nuts, washers, DTI's, and inserts, as applicable, for the bolting of galvanized members.

C. Paint shall be applied only to dry surfaces, only at times when steel surface temperatures are above the dew point, and shall be applied thoroughly and evenly without sags or holidays. Paint shall be applied by suitable spray equipment in strict accord with the paint manufacturer's printed instructions. Provide a dry film thickness within the range specified herein, including around outside corners or other abrupt changes in surface profile.

D. Field Touch-Up shall be provided to field bolts of painted and of galvanized components and to all points of damage, including areas receiving weld after coating.
   1. Unpainted surfaces shall be recleaned to the extent necessary to achieve sound tight bond of other Work.
   2. Painted surfaces shall be cleaned and painted to the standards of the shop coating and touch-up so as to provide for workmanlike surfaces and for tight bond of other Work.
   3. Galvanized surfaces shall be cleaned of slag and burned metal, by vigorous wire brushing and other tools, to base metal free from loose particles. Finish clean by solvents in accord with SSPC-SP1. Field-apply galvanizing touch-up to achieve quality of the original and undamaged shop coating.
   4. Coat no-paint areas after completion of erection.

E. Contact with Aluminum: Surfaces which will be in contact with aluminum shall receive two coats of a dielectric separator over a shop-primed surface.

F. Handling, Shipping, Storing and Erection of Painted Steel: Contractor shall exercise handling means as well as shipping, storage and erection techniques to reasonably protect painted surfaces from damage, abrasion and soiling in order to minimize the need for touch-up painting after erection. Shop paint shall be adequately dry to withstand handling without damage prior to moving or loading steel elements for storage or delivery.

END OF SECTION

SECTION 05 30 00

METAL DECK AND STUD SHEAR CONNECTORS

PART 1 GENERAL

1.1 CONTRACT DOCUMENTS

A. Comply with Contract Documents:
   1. All Work of this Section shall comply with the requirements of the Conditions of the Contract (General, Supplementary and Special), with all Sections of Division 1 - General Requirements, with this Section of the Specifications, with the Drawings and with all other Contract Documents.

B. Flammable Materials or materials not conforming in all respects to the fire resistive and fire safety provisions of governing regulations shall not be left in place in the Work.

C. Disposition of and Exposure to Materials: Contractor, remains fully responsible for the disposition of and for the exposure to persons of all materials, whether or not hazardous.

D. Volatile Organic Compounds (VOC): Contractor remains fully responsible for the supplying of products and materials complying to the VOC limitations set forth by the *Building Code* and by governing agencies having jurisdiction.

1.2 WORK INCLUDED

A. Scope: Contractor shall examine all of the Contract Documents for the extent of the Work of this Section of the Specifications. That Work shall include all labor, materials, devices, plants, tools, equipment, appliances and services necessary to complete the Work as shown in the Drawings, as specified herein, as required by job conditions, and as required by governing authorities having jurisdiction, including but not limited to the following:
   1. Composite and non-composite metal deck as given in Drawings and as specified herein.
   2. Flashing saddles, sumps, closure members, and cover plates at all edges, ends and intersections.
   3. Metal screed at all edges around the building perimeter, around all openings, and as required to prevent leakage of mortar.
   4. Metal flashing and closure plates around all columns and around the Work of other trades which penetrates the deck.
   5. Utilizing metal deck and associated parts, furnish and install concrete slab forming system complete and mortar-tight at building exterior perimeter and around interior openings.
   6. Design of metal deck system by Contractor's Professional Engineer to act as concrete formwork and to support specified superimposed loads.
   7. Hanger tabs and other devices for the vertical support of ceilings, and of light mechanical and electrical devices.
   8. Cutting and forming of holes and openings through metal deck, including the reinforcing of deck to support safely both temporary and permanent construction.
   9. Supports for metal deck not shown or specified or provided under other Sections of this Specification, but necessary for the proper, rigid and safe support of metal deck and of loads imposed thereon.
   10. Corrosion protection, including field touch-up.
   11. Shoring where indicated in Drawings and where required to properly, rigidly and safely support imposed loads.
   12. Field-applied stud shear connectors.
   13. Submittals
   14. All other labor, materials and Work given in the Drawings, specified herein or required to make the metal deck and stud shear connector Work complete.

1.3 RELATED WORK

A. Related Work Specified Elsewhere, Amplified Elsewhere or Included in Other Contracts:
1. Submittals: Section 01 30 00.
2. Owner's shop and field testing and inspection of steel deck and of stud shear connector Work by Testing Agency engaged and paid for by Owner: Section 01 40 00.
3. Cast-In-Place Concrete: Section 03 30 00.
4. Stay-In-Place Steel Form Deck: Section 03 30 00.
5. Concrete Anchors: Section 03 30 00.
6. Masonry: Division 4.
7. Structural Steel: Section 05 10 00.
8. Shop-Applied Stud Shear Connectors: Section 05 10 00.
9. Shop-Applied Concrete Anchors: Section 05 10 00.
10. Painting: Section 09 90 00.

1.4 APPLICABLE CODES AND STANDARDS

A. General: Except as modified or voided by requirements specified herein or by details or notes included in the Drawings, Work specified under this Section shall conform to all applicable provisions of the codes, specifications, standards and other reference documents cited in this Specification and/or noted in the Drawings.

B. Requirements of Codes and Other Reference Documents:
1. Codes, standards, specifications, and other reference documents cited in this Specification are declared to be a part of this Specification, the same as if fully set forth herein. Work shall conform to the applicable provisions of reference documents cited directly by this Specification and shall conform also to codes, standards and specifications, or parts thereof, cited in codes, standards and reference documents stipulated in this Specification.
2. Where provisions of this Specification supplement those of stipulated reference documents, the applicable provisions of the stipulated document(s) plus those of this Specification shall control the Work.
3. Where provisions of this Specification modify or void provisions of stipulated reference documents, the provisions of this Specification shall govern the Work, solely or in combination with the provisions of reference documents as applicable.
4. Recommendations or suggestions in the listed codes or standards shall be mandatory where not in conflict with this Specification.
5. In the event of conflict between provisions of stipulated reference documents and of this Specification or another stipulated reference document, Contractor shall report in writing the details of the conflict. Decisions regarding applicability of provisions of this Specification and provisions of reference documents applied independently or as supplemented, modified or voided, will be provided in writing and shall be final. Resolution of conflicts shall conform to the procedures set forth in the General Conditions of the Contract.

C. Codes: All Work under this Section shall conform to the requirements of the 2018 North Carolina Building Code, hereinafter referred to as *Building Code*, and to the regulations of all governmental authorities having jurisdiction. Where more stringent, the following codes, standards and specifications, latest edition and revision, shall apply to the Work, all as modified herein or by *Building Code*:
1. "*North American Specification for the Design of Cold-Formed Steel Structural Members"*, by the American Iron and Steel Institute (*AISI Specification*).
2. *Design Manual for Composite Decks, Form Decks, and Roof Decks*, by Steel Deck Institute.
3. *Specification for Structural Steel Buildings*, by the American Institute of Steel Construction, Inc. (AISC Specification).
4. *Code of Standard Practice for Steel Buildings and Bridges* , published by the American Institute of Steel Construction, Inc. (*AISC Code*). Sections 6, 7 and 8 only shall apply to the Work, except as modified in this Specification; the remainder being specifically excluded.
5. *Structural Welding Code - Steel*, AWS D1.1.
6. *Structural Welding Code - Sheet Steel*, AWS D1.3.
7. *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, AWS A2.4.

8. Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding, AWS A5.1

D. Reference Documents: To the extent that the best quality of Work is provided, Work shall conform to the examples, procedures and recommendations listed below, latest edition and revision. Where provisions of the, *Building Code* this Specification, or codes, standards, manuals and specifications cited by this Specification are more restrictive or provide increased quality, the combination of provisions, examples, procedures and recommendations which provide both best quality and *Building Code* conformance shall control the Work.
   1. *Composite Steel Deck Design Handbook*, by Steel Deck Institute.
   2. *Manual of Construction with Steel Deck*, by Steel Deck Institute.
   3. *Standard Practice Details*, by Steel Deck Institute.
   4. *Roof Deck Construction Handbook*, by Steel Deck Institute.
   5. *Cold-Formed Steel Design Manual*, by the American Iron and Steel Institute.
   6. *Diaphragm Design Manual*, by Steel Deck Institute.
   7. *Manual of Steel Construction Allowable Stress Design*, Ninth Edition, by the American Institute of Steel Construction (*AISC Manual*).
   8. *Manual of Steel Construction, LRFD*, by the American Institute of Steel Construction (*AISC Manual*).
   9. "*Steel Structures Painting Manual*", Volume 1 and Volume 2, by Steel Structures Painting Council.

E. ASTM (American Society for Testing and Materials) Specifications cited in this Specification or cited in reference documents shall be the year of adoption or tentative adoption and revision listed in the latest edition of the Annual Book of ASTM Standards Index, except that, should a specific year of adoption or revision be cited by the Contract Documents, by *Building Code*, or be proposed by Contractor and accepted by Structural Engineer, that edition shall apply to and control the Work.

F. Conformance to Regulations: Work of this Section 05 30 00 shall conform to all applicable federal, state, and local laws and regulations.

1.5 SUBMITTALS

A. General: Contractor shall submit samples, Shop Drawings, product data, test reports and data, manufacturer's names, certifications, procedures, methodology statements, and the like as stipulated in the drawings and/or in this Specification. With the exception of samples, submittals shall be in PDF format and transmitted electronically, unless otherwise accepted.
   1. Review of Contractor's submittals is only for the limited purpose of the examination of submittals for conformance with the design concept of the project and to assist Contractor in ascertaining that the information given in the submittals conforms to the requirements of the Contract Documents.
   2. Review of Contractor's submittals is not conducted for the purpose of determining the accuracy or the completeness of the submittal, for dimensions or quantities, or for installation or performance of the system or the pieces(s) being submitted.
   3. Submittals by Contractor implies that Contractor has checked the submittal with care. Where by error or other cause Contractor's check has not been accomplished, Contractor shall not rely on review, but shall first check and shall then resubmit such material as though the submittal had been rejected.

B. Shop Drawings:
   1. General: Shop Drawings, as the term is used under this Section 05 30 00, are not Contract Documents, but are intended to demonstrate the way that Contractor intends to conform to the requirements provided in the Contract Documents. Contractor may wish to use these same drawings as a part of the instructions given to craftpersons for the accomplishment of the Work.
   2. Best Standards: Shop drawings furnished under this Section shall conform to the best standards of the construction industry. Shop drawings shall be prepared by and under the supervision of competent engineering personnel. Prior to preparation, Contractor shall retain a Professional Engineer, accepted by Construction Manager and by Structural Engineer and registered in the State of this project, to supervise the preparation of and to check each Shop Drawing for compliance with the requirements of the Contract Documents.
      a) Shop Drawings shall be prepared under the direction of personnel completely familiar with Architectural, Mechanical, Plumbing, Electrical and other building trades Drawings.
   3. Shop Drawings shall be submitted for review and to governing agencies having jurisdiction for acceptance in accordance with the provisions of the Contract Documents.

4. Shop Drawings shall show clearly all metal deck Work, attachment welds and stud shear connectors. Work shall not be fabricated or delivered to the site before accepted Shop Drawings have been returned to Contractor. Detail in accord with and to accommodate Contractor's field measurements of supporting and adjoining construction.
5. Welds shall be detailed using symbols conforming to AWS A2.4,*Standard Symbols for Welding, Brazing, and Nondestructive Examination*.
6. Work of Other Sections: Show in Shop Drawings, and dimension thereon, holes required for passage of Work of other Sections through metal deck Work.
7. Shop Drawings shall clearly show the size and the location of each steel deck unit and its supports, all holes and openings including reinforcing for same, and field connection data, complete with all details necessary for assembling the steel deck system.
    a) Performance Requirements: Contractor's Professional Engineer licensed in the project's jurisdiction shall design the metal deck system for the performance requirements of Part 2. As evidence of conformance with this requirement, each Erection Drawing shall bear the seal and signature of Contractor's Professional Engineer. Provide supporting calculations on request.
    b) Stud Shear Connector Layout Drawings for stud shear connectors shall show complete stud layout, details and sections.
    c) Contractor shall direct special attention to the possible need for special provisions and methods to resist safely all stresses caused by erection procedures and equipment, by construction loadings and by forces imposed by natural phenomena.
8. Contractor shall coordinate and cross-check for accuracy, completeness and correct relationship to the work of other Sections, each Shop Drawing prepared for the Work of this Section 05 30 00, including each Shop Drawing prepared by accepted subcontractors. Contractor's check shall include a verification of compliance with the Contract Documents and shall be performed prior to submission and resubmission of each Shop Drawing. Contractor shall certify the coordination, accuracy, and Contract compliance of each Shop Drawing by a written statement placed in each drawing and attested by the responsible person in charge of the Work for Contractor. The personally inscribed initials of the person(s) preparing each shop drawing as well as the detailing agency's supervisor and chief checker shall be included in the title block or similarly prominent location.
9. Detailing Personnel: Shop Drawings shall be prepared under the direction of personnel completely familiar with Architectural, Mechanical, Plumbing, Electrical and other Drawings so as to avoid having metal deck Work interfere with the Work of other trades.
10. Deviations: Should Contractor desire a Deviation from Drawings or Specifications, or both, Contractor shall submit the specific Deviation in writing prior to the submittal of Shop Drawings showing Deviations. Requests for Deviations shall be submitted on Contractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in Shop Drawings, or both, without the required written description on Contractor's letterhead, may not be accepted and shall be sufficient cause for the rejection and the return of such Shop Drawings without further action.
    a) Acceptance of Shop Drawings, including Deviations not detected during Shop Drawing review, shall not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted in writing.
11. Shop Drawing Review: Only Shop Drawings marked "No Exceptions Taken" or "Make Corrections Noted - Resubmission Not Required" may be used by Contractor in the Work. Shop Drawings marked "Make Corrections Noted - Resubmit" shall be corrected or completed (or both) as required and shall be resubmitted. This process shall be repeated the number of times required to achieve the mark "No Exceptions Taken" or "Make Corrections Noted - Resubmission Not Required".
    a) Nonconformities and errors detected during review will be noted in Shop Drawings returned to Contractor upon completion of review. Acceptance of Shop Drawings, including Substitutions and Deviations not detected during review, will not relieve Contractor from sole responsibility to provide Work conforming strictly to the Contract Documents.
    b) Shop Drawing review includes engineering calculations only to the extent deemed necessary to ascertain that Contractor's calculations have been prepared by competent personnel. Contractor alone is responsible for the accuracy and the completeness of Contractor's engineering calculations.

c) Should Architect's or Structural Engineer's marks or corrections be made in any Shop Drawing that would or could result in incorrect fit of any part or result in insufficient strength or stability of the Work, Contractor shall so notify in writing so as to expedite the required correction or modification.

d) Review of Contractor's Shop Drawings does not include a review of bills of material and the like. Accordingly, information required for the review of Shop Drawings shall be contained outside of bills of materials and the like.

12. Resubmission of Shop Drawings: Prior to resubmission of Shop Drawings with additions, deletions, or corrections, Contractor shall circle and identify all changes from prior issues. Drawings submitted without each change both circled and identified clearly will be returned and shall be resubmitted as though the original submittal had been rejected. Each submittal, whether or not accepted or rejected, shall contain a unique revision number, clearly identified.

C. Product Data: Submit printed manufacturer's literature for each manufactured item specified under Part 2 - Products - along with test data as may be requested. Include detailed instructions for application and installation.

D. Certifications:

1. Submit mill test certificates for metal deck and for stud shear connectors. Certificates shall include zinc or paint coating as applicable. Submit to governing agencies having jurisdiction. Comply with all applicable parts of *Building Code* and of ASTM Specification.

a) Mill test reports shall state clearly the governing ASTM specification and shall be certified and notarized by Contractor as conforming in all respects to that specification.

2. Contractor shall certify that materials and systems delivered and installed in the Work are equivalent to assemblies tested under the Underwriter's Laboratories, Inc. listings of fire ratings and bear the Underwriter's Laboratories fire label.

3. Submit test reports, certified by an accepted independent laboratory, verifying the capability of metal deck units to act compositely with the concrete slab and to transfer safely horizontal shearing forces between metal deck and concrete slab when oiled or contaminated to a condition worse than that to be provided in the Work.

E. Assist Owner in preparation and submittal of roof installation and fire rating certifications as may be required to obtain insurance coverages.

F. Governing Agencies: Provide all shop Drawings, tests, inspections, reports, affidavits, manufacturer’s certifications, certification of compliance with VOC limits, and other requirements and data to governing agencies having jurisdiction.

G. As-built Shop Drawings: At the completion of the Work, provide to Owner, to Architect and to Structural Engineer, one complete digital set of all Shop Drawings (including Job Standards, Erection Drawings, Field Work Drawings and the like), so as to provide as-built drawings of finished and completed Work under this Section 05 30 00.

1.6 MEASUREMENTS AND TOLERANCES

A. Measurements:

1. Field Measurements: Obtain all field measurements required for proper fabrication and installation of Work covered by this Section 05 30 00. Submit, prior to installation, all measurements indicating discrepancies from the Drawings. Describe in writing and, where applicable, by sketches proposed methods of correcting discrepancies. Measurements are the responsibility of Contractor.

B. Tolerances: Provide metal deck Work, including flutings, screeds, closures and the like to tolerances not in excess of those permitted under Section 03 30 00, "Cast-in-Place Concrete". Contractor's attention is drawn specifically to tolerances at building perimeter, at elevator shafts, and at other penetrations through steel deck.

1.7 TESTING AND INSPECTION

A. Owner's Testing Agency: All work is subject to Special Inspection as required by *Building Code*. Subject to acceptance by Architect, Owner will engage and pay for the services of an independent testing agency (Testing Agency) as outlined in Section 01 40 00, Inspection and Testing. Contractor alone is responsible for the achieving of the required level of quality, both in the shop and in the field. Testing Agency will rely heavily on reviewed Shop Drawings, as described earlier in this Specification, in its examination of as-constructed Work. The selected Testing Agency will meet the requirements of ASTM E329. Contractor shall not retain Owner's Testing Agency for its own work but may, subject to acceptance by Owner, contract through Owner for such work.
   1. On instructions and at locations selected by Architect, Testing Agency may sample materials taken from the as-erected Work.

B. Authorizations: Owner's Testing Agency will not be authorized to:
   1. Authorize or accept deviations or substitutions from the Contract Documents.
   2. Assume any of the responsibilities of Contractor; for example, Testing Agency may not advise formally or informally on any aspect of construction means, methods, techniques, sequences or procedures, or safety precautions and programs in connection with the Work.
   3. Accept Shop Drawings or samples.
   4. Approve or issue a Certificate of Payment, a Change Order, or issue verbal instructions which modify the Contract between Owner and Contractor.

C. Responsibilities and Duties of Contractor:
   1. Performance or waiving of inspection, testing or surveillance by Testing Agency for a given portion of the Work will not relieve Contractor from responsibility to conform strictly to the requirements of the Contract Documents.
   2. Access to Documents, Facilities and Materials: Furnish one copy of each accepted Shop Drawing and of each mill test certificate to Testing Agency. Provide reasonable office, desk and file space at the site to allow Testing Agency to conveniently work with and to maintain project records and drawings. Provide authorized personnel convenient and free access to all parts, locations and areas of Work, including storage areas. Provide hoisting, turning and moving of materials and reasonable quantities of scaffolding, power, casual labor, and other provisions and assistance necessary to allow quality and effective inspection and testing of Work.
   3. Notice: Provide reasonable notice of the initiation of Work, to facilitate and to assist testing and inspection.
   4. Cost of Owner's Tests by Testing Agency will be borne by Owner. However, where additional tests are deemed necessary on account of failure to pass tests, the cost of additional testing will be deducted from payments to Contractor so as to reduce the Contract price.

1.8 QUALITY ASSURANCE

A. Source Quality Control: Contractor's material control procedures shall be effective and shall assure that all Work fulfills the requirements of the project as well as the applicable provisions of the Contract Documents. All structural steel shall be identified and all material shall be tested in accord with the requirements of *Building Code*, of Building Department, of governmental authorities having jurisdiction and of this Specification.

B. Construction Site Quality Control: Contractor shall maintain, on staff, sufficient office, field engineering, and field supervision staff to assure that all data and layout drawings for Work of other Sections is transmitted to detailers to allow proper detailing of holes, penetrations, chases, and the like and to assure proper execution of the Work in the field.

C. Qualifications:
   1. The Contractor performing the Work of this Section must, within the last five (5) consecutive years, have successfully completed in a timely fashion at least two (2) projects similar in scope and type to the required work for this Section.
   2. Contractor shall determine, shall warrant and shall certify that producers, detailer, fabricator, erector, placer and all others involved in the Work, along with their personnel, are experienced, qualified and adequately staffed to undertake the specific Work required under this Section 05 30 00.

D. Steel Deck Erector: The Erector performing the Work of this Section must, within the last five (5) consecutive years, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work for this Section.

E. Stud Shear Connector Applicator: Applicator shall have experience in the stud welding through composite metal deck for at least five (5) buildings of the type of this Work.

F. Welder Qualification: Welders and welding operators performing Work under this Section shall be qualified in accordance with the *Building Code* and with applicable AWS requirements for each specific welding procedure and process which the welder will use in the Work.

G. Documentation of Contract Conformance: Perform quality control functions required to achieve and to document that Work conforms to the Contract Documents. Provide access to Contractor's quality control documents and reports upon request. Provide reasonable numbers of photocopies of specific quality control reports on request.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:
   1. Deck items stored on or off the project site shall be supported above ground on platforms, skids or other supports. Where applicable, stacked members shall be separated by effective softeners. Storage methods shall protect deck units from overstress, permanent deformation and other damage.
   2. Deck shall be protected from corrosion. Storage methods shall provide for free and rapid drainage of rainwater and prevent collection of water on or within stored members.
   3. Related Materials shall be delivered to the site, ready for use, in the manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name, and manufacturer's name. Delivered materials shall be identical to accepted samples.
   4. Storage of steel deck bundles, materials, tools and erection aids on the structure shall be performed in manners preventing distortion, damage and overstress of the supporting Work. Damaged members, materials or structural systems shall be replaced or repaired as directed.

B. Identification: Provide and maintain identification in accordance with the AISI Specification and the Steel Deck Institute Specification. Provide ASTM Specification, yield point, and grade, by painting or decal, on each bundle of fabricated elements.
   1. On completion of the Work, Contractor shall submit an affidavit, countersigned by the appropriate subcontractor(s), attesting that all materials and products provided for the Work conform to the applicable specifications, standards, yield points, grades and the like required by the Contract Documents.

C. Handling of Steel Deck: Bundling, stacking and hoisting means shall be capable of placing steel deck units in the Work, free from permanent distortion due to bending of deck edges or buckling of sections.

D. Removal: Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the job site and replaced with acceptable materials.
   1. Construction Manager and Architect shall be the sole judge of the suitability of such materials and neither Owner nor Contractor may challenge Construction Manager's or Architect's decisions as to acceptability.

1.10 JOB CONDITIONS

A. Contractor's Responsibility: Contractor shall be solely responsible for the correctness of dimensions and quantities and for the fitting to other Work; for Work to be confirmed and correlated at the site; for information pertaining to the fabrication procedure or to the means, methods, techniques, sequences and procedures of construction; and for the coordination of the Work of this Section with the Work of all other trades. The verification of the physical interrelationships of elements of the Work from Contract Documents and in the field is solely Contractor's responsibility. Review of Contractor's submissions does not relieve Contractor from these responsibilities.

B. Contractor's Coordination: Contractor shall coordinate and schedule the Work of this Section with the Work of other Sections of this Specification in order to optimize quality and to avoid delay in overall job progress.

C. Rejection of Work: Testing Agency may inspect and test materials at the source before shipment as well as at the site before, during or after installation in the Work. Construction Manager and Architect reserve the right, at any time before final acceptance of the completed Work, to reject material not conforming with specified requirements, regardless of previous tests, inspections, acceptances, or inclusion in certificates of payment.

D. Provisions for Other Work: The Work under this Section shall include required cutting, punching, drilling, welding, reinforcing and all else required for the attachment and the passing-through of other Work.

E. Construction Sequence: Descriptions of limitations on construction sequence are intended to assist Contractor in coordinating the Work of the Project. Descriptions do not describe fully the limitations given, do not describe all limitations, nor do they preclude construction sequences not contemplated herein. Whether or not Contractor follows the limitations on construction sequence described herein, Contractor remains fully responsible for both the stability and the safety of the Work; adherence to the limitations described herein does not relieve Contractor from that responsibility.
   1. Generally, the structure is to be constructed from the bottom to the top, floor-by-floor, with Contractor supplying such temporary bracing and shoring as may be required to compensate for the lack of completion of portions of the construction.
   2. Steel deck Work is essential to the overall stability of the building frame, both before and after the concrete slabs have been cast.
   3. Sealing of Shop Drawings by Contractor's Professional Engineer shall include and imply a full review of construction sequence and of related operations.

F. Construction Loads: The structure is designed to resist safely the loading prescribed by *Building Code* for the finished building. No provision is included for loads or stresses imposed or induced by Contractor's means and methods of construction. Design loads are provided in *Building Code* but are sometimes modified upward as provided in Structural Engineer's Design Criteria.
   1. Where Contractor elects to place loads on the structure or elects to otherwise load or deform the structure in excess of the design loads, Contractor shall submit drawings and supporting calculations prepared under the supervision of and sealed by Contractor's Professional Engineer.
      a) Review of Contractor's submittal shall not relieve Contractor from full responsibility for Contractor's means and methods of construction.

G. Accidents and Hazardous Conditions: Contractor shall prepare a detailed written report of all accidents and other occurrences involving death, personal injury and/or significant losses in tangible property and shall submit the report promptly.

H. Installing and Rigging Equipment: Contractor shall shore all construction susceptible to impact loading from the installation of equipment installed by other trades.
   1. Such equipment shall include but shall not be limited to boilers, chillers, refrigeration equipment, transformers, elevator machines and the like.
   2. Remove shoring when equipment installation is complete.

1.11 DEFICIENT WORK

A. Repairing, Patching, Cleaning: Contractor shall correct all deficiencies in the Work of this Section 05 30 00 including areas where Testing Agency reports or Construction Manager’s or Architect’s rejections have indicated that Work is not in full compliance with the Contract Documents. Perform, at no expense to the Owner, all additional tests which Construction Manager or Architect deems necessary to reconfirm noncompliance of the original Work and perform, at no expense to Owner, all tests and inspections which may be necessary to show compliance of corrected Work.

B. Defective and Nonconforming Work: Defective Work, unsuitable Work or Work otherwise failing to conform to the Contract Documents shall be made good by Contractor at no change in the amount of the Contract. Contractor shall prepare appropriate details and procedures for bringing such Work into conformance with the Contract Documents and shall submit such details and procedures for acceptance. Corrective Work, including materials, shall conform strictly to accepted details and procedures. Nonconforming Work may be rejected at any time, regardless of prior acceptance in Shop Drawings, prior inspection, inclusion in inspection or test reports, or inclusion in certificates of payment.

C. Deficiencies: Where Work exhibits any one or more of the following deficiencies, or where Work otherwise fails to conform to the requirements of the Contract Documents and to the requirements of Building Code, for any reason or combination of reasons, such Work shall be considered deficient and not in conformance with the requirements of the Contract:
   1. Bent, twisted, buckled or warped pieces.
   2. Unauthorized cutting, and so forth.
   3. Exceedance of tolerances.
   4. Painted, unpainted or galvanized surfaces not sufficiently clean to receive spray fireproofing or paint.
   5. Metal deck surfaces not sufficiently clean to receive field-applied stud shear connectors or deck welding.
   6. Workmanship not in accord with the Drawings, with these Specifications, with accepted samples, or with referenced codes or standards.

D. Replacement or Repair: Where Construction Manager or Architect, at its sole discretion, finds any of the above deficiencies or other Work not in accord with the Drawings or with this Specification, Construction Manager or Architect may order that the affected Work be replaced or repaired at Contractor's expense.
   1. Contractor shall reimburse Owner for the actual amount of the fees of Testing Agency for the reinspection and the retesting of Work deemed defective by Construction Manager or by Architect.

E. Cost: The cost of all other activities and procedures associated with defective Work shall be paid by Contractor.

1.12 PROFESSIONAL FEES AND COSTS

A. Scope: Contractor shall compensate Architect, Structural Engineer and Architect's other consultants for services incurred because of Contractor-proposed deviations (including substitutions), extra submittals of Shop Drawings, deficient and defective Work and the like. Compensation will be at the rates given in the standard time-and-expense billing policy of the firm. Architect will notify both Owner and Contractor prior to the commencement of services associated with each item under this Article 1.14.

B. Deviations: Contractor-proposed Deviations will be evaluated and reviewed where requested by Contractor. This service includes the evaluation and review of substitute and alternative materials, products, systems, methods and the like.

C. Shop Drawings: The review of the first and second submittals of each Shop Drawing are normal services but the review of the third and all subsequent submittals of each Shop Drawing will be considered an extra service and subject to the compensation provisions of this Article 1.14.

D. Deficient Work: The evaluation, review and design and all other activities associated with Deficient Work are subject to the compensation provisions of this Article 1.14.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Contractor shall be solely responsible for the design, engineering and adequacy of all metal deck, its connection and accessories.

B. Metal Deck and Accessories Design: Metal deck and accessories shall be designed by Contractor's Professional Engineer licensed in the project jurisdiction.
   1. Initially, composite steel deck and its accessories acts as a concrete formwork system. Formwork shall be designed to withstand all forces imposed upon the formwork including all construction dead and live loads, horizontal loads from equipment, wind and earthquake forces and forces due to vibration of plastic concrete.
   2. The steel deck, whether as a composite deck or roof deck, shall also be designed to support the superimposed loads shown in the drawings for the finished structure.

C. Deck Connections: Metal deck fastening to steel and side laps shall be designed by Contractor's Professional Engineer licensed in the project jurisdiction. Acceptable fastening methods include fusion Welds, powder actuated fasteners and screws. Connection design shall be sufficient to maintain building alignment and to sustain construction loads without distortion or separation.

D. Section Properties for Metal Deck Units shall be based on the design provisions of the AISI Specification and with the assumption that the deck is fabricated from FY = 50 ksi material.
   1. Provide not less than the deck section properties shown or scheduled in Drawings or given in this Specification.
   2. Provide section properties as needed to meet criteria given in Drawings and in this Specification and as needed to meet best quality standards.
   3. Metal deck shall be of sufficient stiffness to properly and safely sustain the weight of wet concrete with a maximum deflection of not more than 1/180 of span or ¾ inch, whichever is smaller.

E. Thickness: The minimum thickness of steel deck before coating with paint or metal shall not be less than 95% of the design thickness as per the Steel Deck Institute Design Manual. Thickness tolerances such as given in Table 2 of ASTM A924 are not acceptable. Submit reports of all metal deck thicknesses for acceptance prior to fabrication.

F. Flashing and Screeds shall be not thinner than 18 gauge and shall be adequately stiff and strong to meet all imposed loads and criteria.

G. Floor Diaphragm: Provide steel deck floor diaphragm sufficiently stiff and strong so as to adequately brace structural steel Work until such time as concrete has been cast and cured.
   1. Where given in Drawings, provide stipulated diaphragm shear strength; do not increase allowable stresses in achieving the required diaphragm shear strength; provide a factor of safety of not less than 3.0 for welds and/or mechanical fasteners required to achieve and/or to transfer diaphragm shears.

H. Unshored Steel Deck: Design steel deck to be unshored throughout.
   1. Metal thickness shall be not thinner than 20 gauge, heavier where noted in Drawings, required by this Specification or required to meet stress, deflection, rigidity and safety requirements.

2.2 MATERIALS

A. Steel Deck:
   1. Metal deck shall be fabricated from steel conforming to Section A3 of the AISI Specification.
   2. Steel for galvanized finish: ASTM A653, Structural Steel (SS) grade 50 or higher, not thinner than 20 gauge. Provide a minimum yield point of 50 ksi.
   3. Steel for prime painted finish: ASTM 1008, Structural Steel (SS) grade 50, or higher, not thinner than 20 gauge. Provide a minimum yield point of 50 ksi.
   4. Galvanizing shall conform to ASTM A924 with a minimum coating class of G60 (Z180) as defined in ASTM A653. For installation over pits to be enclosed under waterproofed decks and at roofing levels, use coating G90 (Z275) or heavier. All metal deck shall be galvanized, unless otherwise noted.

5. Metal deck manufacturer shall be a member of the Steel Deck Institute. Deck units shall incorporate deformations specifically designed to produce composite action between the metal deck and the concrete slab to be placed over the deck. Provide panels with integrally embossed or raised pattern ribs and interlocking side laps to comply with SDI Specifications and Commentary for Composite Steel Floor Deck, SDI Publication No. 30 with the minimum section properties indicated. Accepted manufacturers and profiles are:
   a) CANAM Steel Corporation
      i) 3” Lok-floor
   b) Vulcraft Division of Nucor Corp.
      i) 3” VLI composite floor deck, 3”
   c) Other where accepted in writing by Structural Engineer.
   d) Where membrane waterproofing is to be applied/adhered directly to the surface of the overlying concrete, the deck shall be ventilated to allow for the escape of moisture. This deck shall have the same load-carrying capacity as non-ventilated deck and shall be certified by the deck manufacturer and approved by the membrane manufacturer for compliance with the guarantee requirements of the membrane manufacturer.

B. Sheet Metal Accessories: Pour stops, column closures, cover plates and the like shall be the type required by the Steel Deck Institute and shall conform to ASTM A924 with a minimum coating class of G60 (Z180) as specified in ASTM A653. Provide materials with a yield point of 50 ksi.

C. Galvanizing Repair Paint: Provide organic, zinc-rich paint that contains at least 90% zinc particles in the dried film for the repair of damaged galvanized surfaces. Galvanized paint shall comply with either ASTM A-780, Federal Specification DOD-P-21035 or Military Specification MIL-P-26915.
   1. Brite Zinc, by Brite Products
   2. ZIRP, by Duncan Galvanizing Corp.
   3. ZRC Cold Galvanizing Compound, by ZRC Products Co.
   4. Other where accepted

D. Paint for Non-Galvanized Deck: Deck unit manufacturer's baked-on, two coat rust-inhibitive paint system, for application to metal surfaces which have been chemically cleaned and phosphate chemically treated.

E. Miscellaneous Steel Shapes and Plates: ASTM A572 Grade 50 or as otherwise chosen from steels listed in the AISC Specification.

F. Welding Materials shall conform to *Building Code* and to AWS A5.1 and shall be E7018 (E48018) or E6011 (E41011) for joining steel deck to structural steel and for welding steel deck edge laps; E7018 (E48018) for joining steel shapes and plates.

G. Weld Washers: Weld washers are to be used in containing the arc spot welds in sheet steel thinner than 0.028 inches or where required to prevent burn back.
   1. Thickness shall be not less than 0.056 inches, 16 gage and nominal diameter hole shall be 3/8 inch.
   2. Uncoated material may be used.

H. Stud Shear Connectors: Material and equipment for welded studs and stud shear connectors shall conform to *Building Code* and to AWS D1.1. Stud material shall conform to AWS D1.1, Chapter 7, Type B and to ASTM A108, Grade 1010 through 1020, cold finished carbon steel, with dimensions conforming to AISC Specification. Accepted manufacturers are Nelson Stud Welding Division of TRW, Stud Welding Associates or other accepted manufacturer.

I. Self-Drilling Fasteners for Deck Edge Laps: (1) S-SLC 02 M HWH side lap connector screw as manufactured by Hilti Inc, or (2) #12-14 x 3/4" HWH TEKS/1 as manufactured by ITW Buildex Loadmaster Systems, Inc. or other accepted self-drilling fastener.

J. Power Actuated Fasteners for Deck to Steel Connection: X-HSN-24 or X-ENP-19 powder actuated fastener by Hilti, Inc. or other accepted powder actuated fastener.

K. Lip Hangers shall be not less than 18 gauge galvanized, not less than 2 inch wide, with 3/8 inch diameter hole, shall extend 3 inch below the bottom of the deck, and shall be U.L. approved.

PART 3 EXECUTION

3.1 CONTRACTOR'S INSPECTION

A. Examination of Field Conditions: Examine all surfaces, features and facilities to which Work must be attached or applied, abut or clear. Notify Construction Manager and Architect in writing of all conditions which are or will be detrimental to proper and expeditious installation of Work. Starting of Work shall represent acceptance by Contractor of surfaces and of conditions as suitable and correct for performing Work as specified.

B. Field Measurements: Contractor shall verify, by measurements at the job site, all dimensions affecting the Work of this Section. Field dimensions at variance with those in accepted Shop Drawings shall be reported in writing by Contractor. Decisions regarding corrective measures shall be subject to acceptance and acceptance shall be obtained before starting fabrication of items affected. The starting of Work shall represent acceptance by Contractor of all dimensions affecting the Work of this Section as suitable and correct for the performing of all Work under this Section.

3.2 FORMWORK

A. General: Initially, steel deck Work may act as a concrete form. Contractor shall be solely responsible for the construction, safety and adequacy of all concrete formwork, including its design and engineering as per Section 2.1.

1. Formwork shall be constructed to withstand all forces imposed upon the formwork including all construction dead and live loads, horizontal loads from equipment, wind and earthquake forces and forces due to vibration of plastic concrete. Formwork shall be tight to prevent leakage of mortar, shall be adequately braced to produce true lines to accurate elevations and correct alignments. Provide inspection of all formwork for conformance with this Specification.

3.3 FABRICATION

A. General: Form steel deck unit in lengths to provide 3-span condition where practical. One, two and four span conditions shall be avoided except where openings, building configuration and the like do not allow 3-span condition. Provide flush abutting ends and rigidly connected side laps, unless otherwise indicated. Provide not less than two inches of end bearing on supports. Where provided in Drawings, stagger end laps so as to avoid continuous joints through the deck Work.

B. Weld Size and Spacing joining the bottom flat sheet to the fluted top sheet of cellular sections shall fully develop the section properties of the combined sheets. The design strength per weld shall comply with the requirements of the *AISI Specification*. Weld quality shall conform to UL 209, AWS D1.1, AWS D1.3 and *Building Code*.

C. Side Laps: Take care that side laps can be properly accomplished in the field, noting particularly:

1. improper height of the male leg of the side joint, where fastened by welding, button punching or by self-drilling fasteners; and
2. any other deficiency in the side joint configuration.

D. Sump Pans: Fabricate from a single piece of not less than 14 gauge galvanized sheet steel of the same quality as the deck units. Provide sump pans with sloping bottoms and sloping or vertical sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive drains and with bearing flanges not less than 3 inches wide. Recess pans not less than 1-1/2 inches below the deck surface, unless otherwise shown or required by deck configuration. Holes for drains may be cut in the field or as otherwise provided in Shop Drawings. Reinforce steel deck surrounding openings prior to cutting deck to provide opening.

E. Prevent Loss of Concrete Fines through gaps and openings and provide:

1. closures for cellular and non-cellular deck at columns, openings, changes in deck direction and perimeter conditions;
2. cover plates for flashing at deck edges and end conditions; and
3. edge closures of sufficient strength, stiffness and fit so as to retain concrete with edges true and straight.

F. Factory Cut: To the extent practical, factory cut elements to length.

3.4 ERECTION

A. Install steel deck units and accessories in accord with manufacturer's recommendations, accepted Shop Drawings, and as specified herein.

B. Coordinate and Cooperate with structural steel erection Work, with cast-in-place concrete Work and in locating decking bundles to prevent overloading of structure.

C. Cleaning: Prior to laying out steel deck units, Contractor shall clean surface of supporting steel, removing grease, oil, debris and other deleterious foreign material which may interfere with the consistent achievement of sound welding of stud shear connectors through steel deck and of arc welding of deck units to supports.

D. Bearing: Place steel deck units with 2 inch minimum end bearing and 1-1/4 inch minimum side bearing on supporting framework. Adjust to final position and accurate alignment, end-to-end and edge-to-edge, prior to making permanent attachment. Do not stretch or contract sections or side-lap interlocks. Each unit shall be free from excessive deflection, local distortions and damage when aligned and permanently joined into the structure.

E. Cut and Fit Deck Units and accessories around other Work projecting through or adjacent to the decking, as found in the field and as given in Drawings. Provide neat, square and trim cuts. Provide miscellaneous structural supports at locations where specific support details are not given in the Drawings.

F. Temporary Use: Do not use deck units for storage or working platforms until permanently secured.

G. Preparation: Prior to beginning welding, each steel deck unit shall be brought into intimate contact with steel supporting members and shall be maintained in contact throughout the duration of welding. Prior to stud welding, embossments shall be flattened to the extent necessary to provide uniform contact between the metal of the steel deck unit and the face of the supporting steel member to which the stud is to be fused. Moisture between supporting steel and steel deck units shall be removed immediately prior to welding.

H. Fastening: Permanently fasten steel deck units to supporting member by minimum 3/4 inch diameter arc spot welds or powder actuated fasteners. Welds shall be spaced at 12 inches maximum unless a smaller spacing is given in the Drawings or otherwise required by the provisions of this Specification. Powder actuated fastener size and spacing shall be such that it has the equivalent strength of spot welds. The minimum fastening requirements are as follows:

1. Weld each valley of each unit to each supporting member by minimum 3/4 inch diameter arc spot weld.
2. Weld deck edges and interior ribs to parallel supporting members by minimum 3/4 inch diameter arc spot welds at 12 inches maximum spacing except where a smaller spacing is given in the Drawings or required by this Specification.
3. Elongated welds, both accepted by Structural Engineer and providing strength equal to or greater than 3/4 inch round arc spot welds, may be used.
4. Welds shall be fused thoroughly to the steel deck around the weld perimeter or circumference as well as to the supporting steel member.
5. Stud shear connectors placed at required arc spot weld locations may be considered to replace arc spot welds, one for one.

I. Use Weld Washers where recommended by deck manufacturer, at all locations where metal thickness is equal to or less than 0.0280 inches, and at all locations where required to achieve consistently sound are spot welds.

J. Wind Uplift: Steel deck units (with special emphasis upon roof units and deck units with sump pans) shall be secured to the structural steel to the extent necessary to resist, without overstress, maximum wind uplift forces. Such forces shall be determined from data contained in the Drawings, *Building Code* and or in ASCE 7, whichever is larger.

K. Stud Shear Connectors: Prepare structural steel surfaces as recommended by the stud manufacturer. Use automatic stud welding systems and use such systems in strict accord with the manufacturer's printed instructions. All welding ferrules shall be broken and shall be removed from the Work. Fillet welding shall be used for repair welding only. Arc welding repairs to stud welds shall be made to the extent required by AWS D1.1, Chapter 7.

1. Where deck valleys run transverse to the supporting steel, the number of stud shear connectors in steel deck shown in the Drawings have been calculated on the basis of the w_r/h_r ratios given in the Drawings, a rib spacing of 12 inches, and each rib available for stud placement. Hs has been taken at values given in the Drawings for the configurations noted.
2. Should Contractor wish to substitute a steel deck system with fewer effective shear connection ribs, a different rib spacing, different rib geometry, or a combination of the foregoing conditions, Contractor will be required to provide effective shear connector capacity equaling to or exceeding that available for the shear stud count designated in the Drawings. Stud values shall be calculated on the basis of AISC Specification. Note applicable sections of the Contract Documents as they relate to Contractor-proposed substitutions.

L. Side Laps: Metal deck side laps shall be permanently fastened by either fusion welds or metal screws. The minimum fastening requirements are as follows:
1. Lock side laps between adjacent deck units by welding at intervals not exceeding 36 inches or by self-drilling screws at intervals not exceeding 36 inches.
2. At cantilever spans, side lap locks shall be placed not more than 3 inches from deck end and at intervals not exceeding one-half of normal spacing.

M. Comply with AWS D1.3 for welding of steel deck including provisions regarding appearances, quality of welding and corrective methods. Use certified welders throughout.

N. Punched Slots at Slabs Receiving Waterproof Membrane: Provide punched slots between flutes in all steel deck forming slabs which will receive waterproof membrane treatment. Hanger-tab slots along each rib at 12 inches on center, that have been bent down in the field, are satisfactory for this purpose.

O. Reinforcement at and Cutting of Openings: All proposed openings shall be submitted for review prior to construction. For composite slabs, Contractor shall cut openings in deck only after concrete has reached design strength. Reinforcement of openings in metal deck shall be designed by Contractor's Engineer except in cases where LERA has specified bottom rebar or specifically designed the metal deck. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other Work. At a minimum, reinforce decking around openings in accordance with details and notes given in the Contract Documents and in accepted Shop Drawings.
1. Unframed openings larger than 6 inches, and all cases where deck strength is impaired, shall be reinforced to the extent required, but not less than:
    a) Holes 6 inches to 12 inches: provide 16 gauge or thicker flat sheet, extending at least 6 inches beyond hole on all sides.
    b) Holes 12 inches to 18 inches: provide 2 x 2 x 3/16 or thicker angle, extending at least 16 inches beyond hole in both directions.
    c) Weld all of needed reinforcing to top side of unfilled/roof deck and bottom side of composite deck.

P. Roof Sump Pans: Place roof sump pans over openings in the roof decking and weld to the top decking surface. Space welds not more than 12 inches center-to-center with at least one weld at each corner. Cut openings in the bottom of the roof sump to accommodate the drain size indicated. Proportion roof sump pans and their connections as applicable to resist maximum wind uplift pressures.

Q. Closures: Provide metal closure strips at all open uncovered ends and edges of decking and in the voids between decking and other construction. Closure strips shall be not thinner than 20 gauge, and shall be galvanized sheet steel of the same quality as the deck units. Weld into position to provide a complete decking installation. Provide flexible adhesive faced closure strips where needed to ensure complete closure. Closure pieces shall be fitted neatly and shall be installed leaving no open gaps or unsightly conditions. Sheet metal flashings shall be provided to close openings between floor units and columns and other penetrating Work, to close ends and edges of units at the building perimeter, to close discontinuous ends and edges, and to close edges of steel deck units at interior span ends or openings.
1. Do not obstruct deck valleys whether or not reinforcing steel in valleys is required to continue past ends of deck.
2. Do not close deck ribs using details which will in any way reduce concrete volume around stud shear connectors.

R. Building Interior and Exterior Perimeter Edge Conditions: Fabricate gauge thickness sheet steel edge angles, bent plate angles and rolled steel angles. Provide material of not thinner than 12 gauge, with a 45° continuous, 1 inch deep hook with adequate shop fabricated and shop attached stiffeners. Fabricate edge condition members to accommodate facade support system members and fittings. Provide and weld in place, all gauge thickness edge angles, bent plate angles, miscellaneous support angles, corrugated sheet steel, sheet steel closures and all else needed to conform to details and notes given in the Drawings and in accepted Shop Drawings. Edge conditions installation shall be true to line and elevation, suitable to receive concrete without leakage or distortion, and ready to receive facade support system. Pay strict accord to edge tolerances as provided in Section 03 30 00 - "Cast-In-Place Concrete".

S. Joint Covers: Provide metal or tape joint covers at abutting ends of deck units. Tape and seal all joints in accordance with or better than the standard accepted details of the manufacturer of the steel deck units.

T. Stools or Shims: Provide stools or shims where support does not meet bottom of deck.

U. Touch-Up Painting: After decking installation is complete, wire brush, clean and paint scarred areas, welds and rust spots on the top and bottom surfaces of decking units and supporting steel members. Touch-up galvanized surfaces with galvanizing repair paint, applied in strict accord with manufacturer's printed instructions. Touch-up shop painted surfaces with the same paint used in the shop, as recommended by the deck manufacturer.

V. Clean Surfaces: Leave all steel deck surfaces free and clean, including breaking, removal and disposal of all stud welding ferrules. Remove all salt and other forms of chloride ion prior to concreting. Provide additional cleaning on underside of deck where required to assure full bond of fireproofing materials.

W. Lip Hangers: Locate at all deck side laps, spaced not more than 14" o.c. , but not more than 4" from the edge of beam flanges and from non-continuous ends of deck.

X. Completion**:** The steel deck installation, upon completion, shall be neat in appearance and suitable to receive concrete without leakage between sections or through end and edge closures.

END OF SECTION

SECTION 054000

COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the cold-formed metal framing as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. "C" shaped steel studs for exterior non-load bearing wall frame construction.
2. "C" shaped steel joists.
3. Anchors and accessories.
4. Gypsum sheathing.
5. Field inspection.

1.3 RELATED SECTIONS

A. Structural Steel - Section 051200.
B. Thermal Insulation - Section 072100.
C. Interior steel stud construction - Section 092900.

1.4 QUALITY ASSURANCE

A. Component Design: Compute structural properties of studs in accordance with AISI "North American Specification for the Design of Cold Formed Steel Structural Members."
B. Fire-Rated Assemblies: Where framing units are indicated to be components of fire resistance rated assemblies, provide cold formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction. Products used in the assembly shall carry a classification label from an approved testing and inspection agency.
C. Qualifications
   1. Manufacturer's Qualifications: Minimum five years' experience in producing products of the type specified.
   2. Installer's Qualifications: Minimum three years' experience in installation of the type of product specified.
   3. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M "Structural Welding Code - Steel" and AWS DL3 "Structural Welding Code – Sheet Steel."
D. Pre-Installation Meeting
   1. Convene meeting at project site within one week of scheduled start of installation with representatives of the following in attendance: Owner, Architect, General Contractor, and metal framing subcontractor.
   2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
   3. Keep minutes of meeting, including responsibilities of various parties and deviations from specifications and installation instructions. Distribute minutes to attendees within 72 hours.
E. Comply with the following standards:

   1. American Iron and Steel Institute (AISI):

a. "North American Specification for the Design of Cold-Formed Steel Structural Members," latest edition.
b. "Standard for Cold-Formed Steel Framing General Provisions."

2. American Welding Society (AWS):
a. Structural Welding Code (D1.1).
b. Specifications for Welding Sheet Steel in Structures (E1.3).

3. ASTM:
a. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coted (Galvannealed) by the Hot-Dip Process.
b. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
c. ASTM A 924 - Standard Requirements for Sheet Steel, Metallic-Coated by the Hot-Dipped Process.
d. ASTM C 955 – Standard Specification for Cold-Formed Structural Framing Members.
e. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic and Non-Metallic-Coated for Cold-Formed Framing Members.
f. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
g. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold- Formed Steel Framing Connections.

F. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non load-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be to be evaluated as part of this specific assembly test. The basis of design product listed herein is a component of the design test assembly selected by the Architect.

1.5 SUBMITTALS

A. Product Data: For information only, submit copies of manufacturer's product information and installation instructions for each item of cold-formed framing and accessories.
B. Shop Drawings
1. Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data. Include placing drawings for framing members showing size and gauge designations, number, type, location and spacing. Indicate supplemental bracing, splices, window and door headers accessories and details as may be required for proper installation.
2. If the Contractor elects to prefabricate framing members into panels for erection, he shall submit shop drawings of such panels at suitable scale showing all dimensions, components, and methods of fastening and support.
C. For fasteners, submit product data sheet and samples.
D. Engineering Data
1. Submit Engineering Data drawings to the Architect for review. The Contractor is responsible for the structural design and supports for the cold-formed metal frame and must show his proposed system and how the Performance Criteria noted below is accommodated on these drawings.
2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of Florida and shall be signed and sealed by this Engineer.
E. Quality Assurance Submittals: Submit the following:
1. Qualifications: Proof of manufacturer and installer qualifications.
a. Member in good standing of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance.
b. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.
2. Structural design calculations.

3. Certificates
   a. Submit mill certificates by framing member/accessory manufacturer certifying compliance with material requirements.
   b. Welder certificates.
4. Manufacturer's installation instructions for framing members and framing accessories.

1.6 PERFORMANCE CRITERIA

A. Cold-formed metal framing system shall be designed, fabricated, and installed to withstand a suction and pressure load per Building Code (or greater if required by Code) with a maximum deflection of L/360 with wall panels.
B. Cold Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100 and AISI S200 and ASTM C955, Section 8.
C. Design system to accommodate vertical deflection of structural building frame, live loading, seasonal and day/night temperature ranges and construction tolerances.
D. Comply with 2015 International Building Code requirements for seismic connections and loads.

1.7 PRODUCT DELIVERY AND STORAGE

A. Protect metal framing units from rusting and damage. Deliver to one project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry ventilated space or protect with suitable waterproof coverings. Conform to storage and handling requirements of AISI "Code of Standard Practice."

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide cold-formed steel framing manufactured by Marino/Ware, Superior Steel Studs, Clark Dietrich Building Systems, Super Stud Building Products, or approved equal.

2.2 METAL FRAMING: GENERAL

A. System Components: With each type of metal framing required, provide manufacturer’s standard steel runners, (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories, as recommended by manufacturer for the applications indicated, as needed to provide a complete metal framing system.

2.3 MATERIALS

A. Steel Sheet for Studs and Tracks: ASTM A 1003 Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 galvanized coating.
B. Steel Sheet for Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating G90 galvanized coating.

2.4 FRAMING MEMBERS

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges; thickness and grade as required by structural performance.
B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths compatible with studs, un-punched, with un-stiffened flanges; thickness and grade as required by structural performance.

2.5 FRAMING ACCESSORIES

A. Stamp manufacturer's name on each accessory item.

B. Provide screws with accessories designated for screw attachment.

C. Connector Devices

1. Vertical Deflection Clips: "VertiClip," including step bushings, as manufactured by The Steel Network Inc. (919) 845-1025 or approved equal. Rigid attachments to structure and screw attachment to stud web using step-bushings to permit frictionless vertical movement. 68 mils minimum thickness, size as required by structural design calculations.
2. Rigid Clip Angles: "StiffClip" as manufactured by The Steel Network Inc., or approved equal, size as required by structural design calculations. Rigid attachment to structure and stud web.

D. Bridging

1. Cold Rolled Channel: 1-1/2" by ½" by 56 mil thick.
   a. Bridging Clip: "BridgeClip" as manufactured by The Steel Network Inc. or approved equal. Provide attachment through stud punch-out clamping onto stud web and wrapping around bridging channel. Provide holes for screw attachment to stud web and channel.
2. Flat Strap: Width and thickness as required by structural design calculations. Rigid attachment to stud flange.
3. Solid Bridging: Channel shaped bridging with lipped flanges and integral formed clips. Screw attachment to stud. 33 mils minimum thickness, size as required by structural design calculations.
4. Bridging and accessories shall be hot dip zinc coated per ASTM A 153.

E. Header for Window and Door Openings: Provide "ProX Header" system made by Brady Innovations LLC, or approved equal complete with all accessories including clips and accessories; finish and gauge to match studs.

2.6 FASTENERS

A. Screws: Corrosion resistant coated, self-drilling, pan or hex washer head. Provide screw type and size as required by structural design calculations.

B. Anchor Bolts and Studs: ASTM A 307, Grade A, carbon steel, with hex-head carbon steel nuts and flat steel washers. Hot-dip zinc coated in accordance with ASTM A 153. Provide bolt or stud type and size as required by structural design calculations.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

2.7 GALVANIZING TOUCH-UP

A. For touching up damaged galvanized surfaces after erection, provide "Silver Galv" made by Z.R.C. Worldwide. Apply to a dry film thickness of 1.5 to 3.0 mils.

2.8 GYPSUM SHEATHING AND RELATED ACCESSORIES

A. Gypsum Sheathing: 5/8" thick "Dens-Glass Fireguard," Type X, made by Georgia Pacific, "Securock Glass Mat Sheathing" made by U.S. Gypsum Co., "Gold Bond EXP Extended Exposure Sheathing" made by National Gypsum Co., "Weather Defense" made by Lafarge/Continental, or approved equal, meeting ASTM C 1177, Type X.

B. Fasteners: 1-1/4" Type S-12 screws "Climaseal" finish.

C. Joint Treatment: Provide a one-part high performance sealant conforming to ASTM C 920, Type S, Grade NS, Class 25 meeting with the approval of the air/vapor barrier manufacturer for compatibility; see

Section 072700 for description. Apply a 3/8" bead of sealant to the joint and trowel flat. Apply enough of the same material to each fastener to cover completely when trowelled flat.

2.9 FABRICATION

A. Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly.
B. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting or screw fasteners, as standard with manufacturer.
C. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where cold-formed metal framing is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION: GENERAL

A. Methods of construction shall be piece by piece.
B. Connections shall be accomplished with self-drilling screws or welding so that the connection meets or exceeds the design loads required at that connection.
C. Studs shall be installed seated squarely (within 1/16") against the web portion of the top and bottom tracks. Tracks shall rest on a continuous, uniform bearing surface.
D. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of loaded members is not permitted. Cutting of loaded members is not permitted unless under supervision of the project architect or engineer.
E. Temporary bracing shall be provided and left in place until work is permanently stabilized.
F. Bridging shall be of size and type shown on the approved shop drawings and as called for in the engineering calculations.
G. Install headers in all openings that are larger than the stud spacing in that wall. Form headers as shown on the drawings.
H. Insulation meeting the requirements of Section 072100 shall be placed in all jamb and header type conditions that will be inaccessible after their installation into the wall.
I. Provide jack studs to support each end of headers. These studs shall be securely
connected to the header and must seat squarely in the lower track of the wall, and be properly attached to it.
J. If, by design, a header is low in the wall, the less than full-height studs (cripples) that occur over the header shall be designed to carry all imposed loads.
K. Wall track shall not be used support any load unless specifically designed for that purpose.
L. All axially loaded members shall be aligned vertically, to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections or alternate provisions for load transfer may be made.
M. Holes that are field cut into steel framing members shall be within the limitation of the product and its design. Provide reinforcement where holes are cut through load bearing members in accordance with manufacturer's recommendations and as approved by the Architect or Engineer.
N. Touch up all steel bared by welding using touch-up coating specified herein.
O. Studs shall be spaced to suit the design requirements and limitations of collateral facing materials.
P. Care should be taken to allow for additional studs at intersections, corners, doors, windows, control joints, etc., and as called for in the shop drawings or design calculations.

Q. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar

work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

R. Provide for structure movement, expansion shall be allowed where indicated and necessary by design or code requirements.

S. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

T. Install horizontal bridging in stud system, spaced (vertical distance) at not more than 48 inches on center. Fasten at each intersection.

U. Splicing of axially loaded members or floor joists shall not be permitted.

V. Wire tying of members is not permitted.

3.3 INSTALLATION OF GYPSUM SHEATHING

A. Fasten sheathing to exterior of each stud with specified fasteners spaced 3/8" from ends and edges and approx. 8" o.c. at each stud. Install fasteners in accordance with manufacturer's recommendations using 2500-RPM maximum screw gun. Sheathing board shall be installed horizontally. Apply sealant between joints and trowel flush and apply sealant around sheathing perimeter and at interface with other materials. Cover fastener heads with sealant and trowel flush.

B. Refer to Division 7 for air barrier description.

END OF SECTION

SECTION 057000

ORNAMENTAL METALWORK

PART 1 GENERAL SCOPE

1.01 COMPONENTS OF THE WORK:

A. The Trade Contractor shall engineer, test, fabricate, deliver, install, and warranty all construction necessary to provide all Ornamental Metal Systems (OM) including all measures that may be required to that end, notwithstanding any omissions or inadequacies of the Contract Documents. The work of this Section shall include, but is not limited to, the following:

B. Components of the Work:

1. Perforated Powder Coated Aluminum Sheet Guardrail Panels:
   At the bridges that connect the elevator and stair to the exiting first and second floor corridors of Caldwell Hall and at the egress stairs runs there are aluminum and steel panel guardrail assemblies that are part of the project scope. The guardrail assemblies consist of panelized perforated powder coated aluminum sheets mounted between painted and galvanized vertical steel bars that are attached to the primary bridge framing members and the stair stringers. The minimum height of the guardrail assembly as measured from the adjacent platform pavers is 42". The guardrails are constructed of perforated aluminum with folded edges for stiffening and mounted to painted and galvanized steel posts between the panel sections that mount to with painted and galvanized steel plates on the bridges and stairs HSS members.
2. Galvanized Steel Stairs Treads and Planks:
   The egress stair runs leading from the second to first floor and the first floor to grade are made from treads planks of perforated galvanized steel that are supported by galvanized steel plate fins off galvanized HSS stringers. The perforated tread planks provide the stair with drainage and for adequate texture for slip resistance.

C. Elements of the Work:

1. Perforated powder coated perforated aluminum sheet guardrail panels.
2. Galvanized steel stairs treads and planks.
3. Primed and painted galvanized guardrail posts.
4. Brushed stainless steel handrails
5. All anchors, fixings, attachments and reinforcements except those specifically indicated as being provided by other trades.
6. Finishes, protective coatings and treatments.
7. Testing and verification of design, components and total assembly.
8. Material samples and mock-ups.
9. Shop drawings, calculations, engineering data and test reports.
10. Scheduling and monitoring of the Work.
11. Coordination with the work of other trades.
12. Storage, handling, protection and cleaning.
13. Guarantees, warranties and indemnities.

1.02 RELATED SECTIONS:

A. Cast-In-Place Concrete.
B. Structural Steel.
C. Aluminum Frame Entrances and Storefronts

1.03 REGULATIONS AND STANDARDS

A. All work of this Section shall comply with the requirements of all regulations and standards of the 2014 International Building Code.
B. All standards and codes referenced in this Specification shall be those editions, including all amendments current at the date of this Document.
   1. British Standards as issued by the British Standards Institute (BS).
   2. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings issued by the American Institute of Steel Construction (AISC).
   3. The Code for Welding in Building Construction issued by the American Welding Society (AWS).
   4. Specification for Structures of Aluminum Alloys issued by the Aluminum Association (AA).
   5. The specified documents of the American Society for Testing and Materials (ASTM).
   6. Specifications and guidelines issued by the American Architectural Manufacturers Association (AAMA)
   7. Specifications and guidelines issued by the Structural Steel Painting Council (SSPC).
   8. Steel finish designations issued by the American Iron and Steel Institute (AISI).
   9. The metal and alloy designations of the Uniform Numbering System (UNS).
   10. The hardware finish designations of the Builders Hardware Manufacturers Association (BHMA).
   11. Standards and alloy designations of the American Casting Institute (ACI).
   12. The standards issued by the Consumer Products Safety Commission (CPSC).
C. In case of any conflict between referenced codes and standards and/or the Contract Documents, the more stringent code or standard shall govern.

1.04 PERFORMANCE CRITERIA:

A. Individual and aggregate components of the Work of this Section shall be designed, fabricated, assembled, transported, installed and protected so that no evidence of the following shall be apparent, visually or measurable, when Work of this Section is subject to the pressures, loads, temperatures, and conditions specified.
   1. Damage of any kind.
   2. Deflections:
      a. Vertical members: deflection normal to the plane of construction shall be L/175 of the clear span (L) between structural supports or 20 mm, whichever is less.
      b. Cantilevered members: deflection normal to the plane of construction shall be 2L/175 of the span (L) beyond the structural support or 20 mm, whichever is less. When cantilever members comprise a part of a continuous mullion system or framing member, the maximum deflection of the composite framing member shall not exceed the deflection limitation specified in Item 2a or 2c.
      c. Transverse members: deflection normal to the plane of construction shall be L/175 of the clear span (L) or 20 mm, whichever is less; deflection in the plane of construction shall be L/360 of the span (L) between structural supports or 3 mm, whichever is less.

d. Bridge support members: deflection normal to the plane of construction due to live load shall be L/360 of the clear span (L), total deflection normal to the plane of construction due to live and dead loads shall be L/500 of the clear span (L).
e. Center deflection of vertical guardrail panels under design loading shall not exceed L/10t where L is the short span of the panel in mm and t is the thickness of the panel in mm.
f. Center deflection of guardrails panels shall not exceed 2 mm.
g. Panels: deflection normal to the plane of construction shall be L/175 where L is the short dimension of the panel or the clear span of the face material between supporting (stiffening) members, whichever is less. This position is to be measured in relation to the actual (deflected) position of the supporting member.

3. Offset from true alignment between adjoining components in line in excess of 1 mm.

B. Loads on Guardrail assemblies:
1. Guardrail assemblies shall withstand the greater of the following pressures action normal to the surface as per 2006 Ontario Building Code, 4.1.5.15 (Loads on Guards)
a. Horizontal linear on guardrails of 0.75 kN/m inward of outward
b. Concentrated horizontal load of 1.0kN at any point, inward or outward.
c. Horizontal pressure load of 0.5kPa inward or outward.
d. Linear vertical load of 1.5kN/m or 103p/ft
2. Handrails and their supports shall withstand the following loading values (Handrails)
a. Concentrated load not less than 0.9 kN applied at any point and in any direction
b. Linear handrail load of 0.70 kN/m in any direction to handrails
3. In no case shall sheet or plate thickness be less than that shown on the Drawings, or the minimum thickness specified herein.

C. Thermal Movement:
Guardrail systems shall be designed for expansion and contraction resulting from a building interior temperature range of 10°C - 40°C and an exterior surface temperature range of 10°C - 90°C.

H. Structural Movement:
Provision shall be made in the design of the guardrail systems to accommodate differential structural movements, deflections, and other movement of the building structure(s) due to gravity loads, live loads, and temperature. It is the responsibility of the General Contractor and the Trade Contractor to refer to the specifications for Concrete Work and Structural Steel for the full description of building tolerances and for coordinating and agreeing to all structural movement with the contractors for those specific trades.

I. Building Tolerances:
Provision shall be made in the design of the guardrail systems for the erection tolerances of building structure(s). The Trade Contractor shall refer to the appropriate specifications for Concrete Work for a full description of building tolerances and shall be responsible for coordinating and agreeing to all building tolerances with the contractors for those specific trades.

1.05 TESTING AND MOCK-UPS:

A. Visual Mock-ups:
1. Provide Visual Mock-ups of the following components for review and approval by the Owner, the Architect, and the structural engineer prior to beginning fabrication of the job material.
a. Perforated powder coated aluminum sheet guardrail panels: two panel segments with vertical painted galvanized steel posts to illustrate typical stair and bridge locations.

b. Galvanized steel stairs treads and planks: two risers and treads with sub-frame assembly to show sloped stringer and guardrail.

2. Visual Mock-ups shall be complete in all respects and shall include actual materials identical to those proposed for use on the actual work.
3. Visual Mock-ups shall be located on-site unless noted otherwise.
4. Fabrication of job material shall not be permitted until Visual Mock-ups have been approved.

B. Trial Installation Mock-ups:
1. Prior to general installation of any given typical portion or system of the Work, the Trade Contractor shall install a representative Trial Installation Mock-up for the Architect's approval at designated locations on the building (actual location) for each of the items mentioned in 1.05A.
2. The Trade Contractor shall propose the scope and location of Trial Installation Mock-ups to the Architect’s approval.
3. The Trade Contractor shall notify the Architect a minimum of three weeks in advance of each such Trial Installation. If approved, this unit may become part of the final installation.
4. The trial mock-up may be installed in its final location if so approved by the Architect and by the project manager. In such a case the mock-up may become part of the finished assembly, provided it is fully approved by the architect without any rejections. If there are rejections to the mock-up the contractor will adjust the mock-up according to the instructions of the architect. The mock-up shall remain in place as park of the final assembly only if all rejections are fixed and if the architect approves of leaving the mock-up in place.

C. Embedded Anchor Testing:
1. Representatives of each anchor type embedded into concrete shall be site tested in accordance with the requirements of ASTM E488 - Test Method for Strength of Anchors in Concrete and Masonry Elements.
2. Each anchor type shall be tested for shear, tension, and shear and tension combined to 1.5 times the design load.
3. As a minimum, 5 percent of each anchor type but no fewer than five (5) anchors shall be tested.

D. Product Engineering Tests:
1. All products and individual or aggregate a component of the Work for which acceptable engineering or test data is not available shall be physically tested.
2. Unless otherwise specified herein, the Trade Contractor shall propose specific test procedures for approval by the Architect.

1.05.1 SUBMITTALS:

A. General:
1. Submit shop drawings, samples, material data and engineering calculations for review and approval by the Architect and the Structural Engineer before proceeding with the Work of this Section.
2. Submissions shall be complete and comprehensive and include all shop drawings, samples, material data submissions, and engineering calculations for the part of the Ornamental Metal Systems addressed. All work shall be coordinated by the General Contractor prior to submission. Incomplete, non-conforming, or uncoordinated submissions shall be subject to rejection or return without action by the Architect.
3. Any work executed which deviates from the approved submittals shall be subject to rejection and shall be removed at the trade contractor's expense.

B. Shop Drawings:
1. Shop Drawings shall clearly illustrate all aspects of the OM including:
a. The relationship of the Work to the structure, glazing, and other related work.

b. The arrangement of components.
c. The sequence and details of fabrication, assembly and erection.
d. Full-size details, including isometric drawings of sealing, flashing and jointing; all dimensions and thicknesses; materials and finishes; material, type, size, location, and spacing of screws, bolts, welds, embeds, and other anchoring devices and accessories.

2. Shop drawings shall include details of all connections to contiguous work as approved by the sub-contractor for the work adjacent and as coordinated by the General Contractor.
3. Clearly indicate all revisions to shop drawings on re-submissions, and mark clearly using revision clouds and indicate edition number.
4. All shop drawing sheets shall be of one size and the final record submission shall bear the seal of a Professional Engineer registered in North Carolina.
5. The shop drawings shall be adjusted by the trade contractor according to comments and rejections of the Architect and the Structural Engineer and re-submitted until approved without any rejections. Work shall only start after all shop drawings receive final approval by the Architect and the Structural Engineer without any rejections.

C. Engineering Calculations:
1. Submit engineering calculations described hereinafter.
2. Engineering calculations shall be submitted concurrently with the corresponding shop drawings.
3. All calculations shall bear the seal of a Professional Engineer registered in North Carolina.

D. Test Reports:
1. Submit test reports for all tests described herein.
2. Test reports shall be submitted in a timely manner and well before execution of any related component of the OM.
3. All test reports are subject to the approval of the Architect and the Structural Engineer.

E. Samples:
1. Submit samples of all materials and finishes. Include:
a. Samples matching the appearance, color, texture and all other characteristics of each finish required.
b. Range samples showing the complete range of variation in color, texture, and other characteristics resulting from the carefully controlled manufacture, finishing, fabricating, delivery, assembly, installation and cleaning processes.
c. Finished samples of major extrusions, built-up steel assemblies, stainless steel castings.
d. Samples showing finishes over welds and over materials welded.
2. Sample submissions shall include three identical pieces of each sample required except for the glass paver for which one sample is sufficient. In addition, the Trade Contractor shall have available an adequate quantity of matching samples, approved by the Architect, in order to permit the coordination of the construction and finishes of other trades.
3. Samples of production materials shall be of the following sizes and shall be finished to match job conditions:
a. Powder coated perforated aluminum panels: 12” x 12”.
b. Painted, primed, and galvanized guardrail posts: 12” in length.
c. Stainless steel handrail tube: 12” in length, straight.
d. Galvanized perforated tread and bridge plank: 12” in length

F. Mock-ups:
1. Provide Visual Mock-ups as described in Item 1.05B.
2. Provide Trial Installation Mock-ups as described in Item 1.05C.

G. Inspection and Production Testing Program:

1. Submit detailed description of inspection and production testing programs and inspection reports for:
   a. Steel welding.
   b. Steel plate galvanizing.
2. Inspection and production testing programs are subject to the Architect's approval.

H. Record Shop Drawings:
At the completion of the project, provide four (4) bound sets of reduced (half-size) photocopies of all final approved shop drawings. Also provide 4 copies of a CD or DVD containing all ca drawings for the final approved shop-drawings (DWG files).

I. Maintenance Manual:
At the completion of the project, submit four (4) bound copies of a maintenance manual describing the various materials, equipment and procedures for cleaning and maintaining the work of this Section. Include the manufacturer's data for all components of the OM.

1.06 MANUFACTURERS, SUPPLIERS AND SUB-CONTRACTORS:

A. The Work of this Section shall be the responsibility of one Contractor.

B. The Contractor for the Work of this Section shall have proven achievement and experience in similar work as applicable for at least ten years and are subject to approval by the Architect and the Structural Engineer.

C. Manufacturers and suppliers of all materials and components of the Work of this Section are subject to approval by the Architect and the Structural Engineer.

1.07 ENGINEERING DESIGN AND DEVELOPMENT:

A. Engineering design development, materials and methods of construction other than that indicated or implied by the Contract Documents may be employed when such materials and methods conform to all of the following:
   1. The design intent.
   2. The performance criteria.
   3. All applicable codes and standards.
   4. Approval by the Architect and the Structural Engineer.

B. Trade Contractor's Professional Engineer:
   1. The Trade Contractor shall retain an experienced registered Professional Engineer, acceptable to the Architect and the Structural Engineer.
   2. The Trade Contractor's Professional Engineer shall prepare and endorse complete engineering design and calculations and shall check and monitor the preparation of all shop drawings for conformance with the engineering design and calculations.
   3. Structural calculations shall be submitted for all components of the OM and shall indicate ultimate factors of safety for each component.
   4. As evidence of conformance to these requirements, each shop drawing and calculation sheets shall bear the seal and self-written signature of the Trade Contractor's Professional Engineer.

C. Manufacturers and Fabricator's Analysis:
   1. Submit written confirmation that the sealant manufacturer has reviewed the pertinent shop drawings and has confirmed the acceptability of the proposed use of the specified products.
   2. Submit fabricator/manufacturer's calculations for design load analysis. Submit written confirmation that the steel fabricator/manufacturer has reviewed the pertinent shop drawings and has confirmed the acceptability of the proposed use of the specified products.

1.08 QUALITY CONTROL:

A. Prior to the start of fabrication, the Trade Contractor shall submit a comprehensive Quality Control Program covering all phases of the OM including, but not necessarily limited to, the following:
   1. Procurement of materials including quality control programs of major suppliers.
   2. Fabrication of components.
   3. Final assembly of components.
   4. Installation and site quality control.
B. The QC Programs submitted are subject to review and approval by the Architect and the Structural Engineer.
C. All QC Programs shall allow for a sufficient sampling to ensure a minimum of 95 percent statistical certainty of conformance with the Contract Documents.
D. The Architect and the Structural Engineer and the supervisor shall be allowed access to the Trade Contractor's facilities and those of the major suppliers and sub-contractors to monitor QC procedures. The Trade Contractor shall make available to the Owner and the Architect and the Structural Engineer all QC Program records upon request.

1.09 INDEMNITY:

A. The Trade Contractor shall agree to indemnify the Owner against any defects in the design, workmanship, quality of materials or performance of the Contract Works and to repair or replace defective design, workmanship or materials of the OM Works during the warranty period.
   1. Abnormal deterioration, aging or weathering of the Work.
   2. Structural failure of components resulting from exposure to pressures and forces within specified limits.
   3. Failure of operating parts to function normally.
   4. Deterioration or discoloration of finishes in excess of normal weathering and aging.
   5. Breakage due to defective design, manufacture, installation, or exposure to pressures and forces within specified limits.
   6. Failure of the Works to meet any other specified performance requirements.
B. The Indemnity does not include damage caused by vandalism or by natural conditions exceeding the performance requirements.
C. The trade contractor shall protect the finished work until final approval and completion certificate by the Architect and shall have sole responsibility for the integrity of the work until such time.
D. The general indemnity period is the ten (10) year period after the Completion Date in the project Completion Certificate.

PART 2 - MATERIALS, PRODUCTS, PROCESSES AND FINISHES

2.01 GENERAL:

A. Materials and components used shall be as specified or shall be suitable equivalents as approved by the Architect and the Structural Engineer.
B. Materials not specified shall be of the best quality and suitable for the purpose intended and as approved by the Architect and the Structural Engineer.

C. All materials shall be free from any defect that may impair the strength, functionality, durability, or appearance of the Work of this Section or of adjacent construction.

D. If the trade worker wishes to suggest an alternate to the material or detail as designed or called for in the specifications, he shall provide certificates and a physical sample of both the original product/detail as deigned by the architect, and of the material he wishes to use as an equal substitute. The suggested material shall only be used if approved by the Architect and the Structural Engineer.

2.02 METALS:

A. Carbon Steel:
   1. Rolled shapes, plates and bars: ASTM A36.
   2. Cold-formed welded and seamless tubing: ASTM A500.
   3. Hot formed welded and seamless tubing: ASTM A501.
   4. Fasteners:
      a. Bolts and screws: ASTM A307, Grade A.
      b. Nuts: ASTM F563.

B. Stainless Steel:
   1. Bars and strip: UNS S30400, ASTM A666.
   2. Sheet: UNS S30400, ASTM A480, BS1449 (Sheet to be stretcher-leveled and stress-relieved; allowable flatness tolerances to be 1/4 of that allowed under ASTM A480).
   3. Pipe: UNS S30400, ASTM A312M.
   4. Castings: ACI Casting grade CF-8, ASTM A743M.
   5. Fittings (interior): UNS S30400, ASTM A580M.
   6. Fasteners:
      a. Bolts and screws: ASTM F738M, BS6105; Grades A2 and A4, non-magnetic.
      b. Socket set screws: ASTM F880M, BS6105; Grades A2 and A4, non-magnetic.
      c. Nuts: ASTM F836M, BS6105; Grades A2 and A4, non-magnetic.

C. Aluminum
   1. Extrusions (anodic finish): AA6063 T5 or T6 (Anodizing Quality), ASTM B221, BS1474.
   2. Extrusions (painted or conversion coat finish): AA6063 T5 or T6, AA6061 T5 or T6; ASTM B221, BS1474.

2.03 PROTECTIVE TREATMENTS FOR METAL:

A. Hot-Dip Galvanizing:
   1. For shapes, plates, bars, and strip: ASTM A123, BS729 (minimum coating thickness of 2 oz/ft^2).
   2. For fasteners and hardware: ASTM A153, BS729.
   3. For sheet: ASTM A525M Z275.
   4. For protection against hydrogen embrittlement: ASTM A143.
   5. For repair of galvanized coatings: ASTM A780.

B. Zinc-Rich Coating System:
   1. Surface preparation: SSPC-SP6 Commercial Blast Cleaning.
   2. Painting system: SSPC-PS12.00 Zinc-Rich Coating System.
   3. Zinc-Rich Primer: SSPC Paint 20 Zinc-Rich Primer - 2 coats.

C. Cadmium Plating: ASTM B766, Class 8, ASTM A143.

D. Zinc Plating: ASTM B633, Class FE/ZN 8, ASTM A143.

E. Zinc-Aluminum Coating: ASTM A792, AZ55.
F. Bituminous Paint: SSPC Paint 12.

2.04 FINISHES AND PROTECTIVE TREATMENTS FOR ALUMINUM:

A. The following aluminum finishes are used for the Work of this Section.
B. All aluminum, whether concealed or exposed shall be finished. No mill finish aluminum shall be permitted.
C. Finishing of all components exposed to view shall be done after the completion of all fabrication processes.
D. Surfaces shall match the appearance, color and texture of samples approved by the Architect.
E. Aluminum not exposed to view shall receive, as a minimum, the chromium phosphate chemical conversion coat associated with organic coating.
    1. All chemical conversion coatings shall meet the minimum requirements of ASTM D1730, Type B, Method 5 with a minimum coating weight of 30 mg/ft^2.
    2. Approved conversion coatings are:
        a. Alodine as manufactured by Amchem Products, Inc.
        b. Bonderite as manufactured by The Parker Company.
F. Clear Anodic Coating:
    1. All aluminum components exposed to view shall receive a clear anodic coating conforming to the minimum requirements of AA-M12C22A41.
    2. All finishing of aluminum shall meet the minimum requirements of BS 3987 and AAMA 611: Voluntary Standards for Anodized Architectural Aluminum, and the ASTM standards specified herein.
    3. Finishing of aluminum shall be through a sulfuric acid anodizing process approved by the alloy manufacturer. Coating shall be a Class 1 clear anodic coating with a certified minimum coating thickness of 25 microns.
    4. All aluminum alloy intended for anodizing shall be of anodizing quality, specifically intended for finishing through anodizing.
    5. Prior to start of production coating, the Trade Contractor shall submit samples of finished extrusions indicating the anticipated range of color and tonality in the finished work.
    6. In the event that aluminum must be sourced from more than one batch of alloy, the Trade Contractor shall fabricate and finish components in such a way that components from different alloy batches are not located contiguous to each other or in the same general area.
    7. To ensure consistency of color and tonality in the finished work, the Trade Contractor shall implement a quality control program to the approval of the Architect. The quality control program shall be vertically integrated and include controls by the alloy manufacturer and the anodizer, as well as the Trade Contractor to provide three independent checks of color and tonality at the point of finishing, during assembly, and during installation.
    8. No production finishing shall commence prior to approval of the quality control program by the Architect & the Aluminum Consultant. Notwithstanding the implementation of an approved quality control program, any installed work with defects in anodized coating or variation in color or tonality in excess of the approved range shall be subject to rejection.
    9. A full-time inspector shall be assigned to each production shift; the inspector shall inspect all production materials and maintain a complete record of all inspections.
    10. Samples of production lots of finished materials shall be tested in accordance with the following ASTM Standards:
        a. Coating Weight: ASTM B137.
        b. Seal Test: ASTM B680.
        c. Stain Resistance: ASTM B136.

d. Coating Thickness: ASTM B244.

11. Testing shall be done on a regular basis to ensure statistical compliance with the QC requirements of Section 1.10. Testing shall be conducted at the following intervals:
    a. Coating Thickness: Each rack-load of processed material shall be inspected.
    b. Coating Seal: Each rack-load of processed material shall be tested.
    c. Coating Weight: One sample shall be finished with a production rack during each production shift and tested for minimum coating weight.
12. Inspection shall be made in a large, enclosed area, using General Electric Natural Daylight or Sylvania Metalarc lamps at a suitable level of illumination. Inspection shall be by visual comparison with previously approved samples and, if necessary, include the use of coordinated empirical inspection methods, such as the use of calibrated multi-angle spectrophotometers.
13. Complete certified inspection records for quality of finish and complete finish process records shall be maintained and made available to the Architect upon request.

2.05 FINISHES FOR STAINLESS STEEL:

A. All stainless steel whether exposed or concealed shall be finished. No mill-finish stainless steel shall be permitted.
B. All fabrication shall be done prior to finishing. All welds shall be ground smooth and finished to match adjacent surfaces, all burrs and foreign particles removed, and any other defects remediated prior to finishing.
C. Prior to finishing, all fabricated stainless steel shall be inspected and if, in the opinion of the finisher, the stainless steel is not sufficiently cleaned to ensure a high-quality finish, the steel shall be cleaned further as required to achieve the finish desired.
D. Verify that all surfaces to be finished are dry, clean and free of dust, dirt, oil, wax, grease or other contaminants.
E. Stainless steel framing and sheet cladding shall typically receive a No 8 mirror-polished finish and then be bead-blasted to achieve a fine-grain non-directional finish to match Architect's sample.
F. All abrasives used in finishing shall be non-corrosive, non-ferrous material.
G. Finish of stainless-steel hardware to be BHMA 630 satin finish.
H. Finish of machined stainless-steel fittings and tension rods to be RMS 32 micro-inch.
I. If concealed from view, finish for stainless steel shall be AISI No. 2D.
J. All stainless steel shall be cleaned and passivated as per the requirements of ASTM A380.

2.07 LOW-FRICTION MATERIALS:

A. Wherever materials are subject by design to relative movement, provide suitable low friction material(s) such as:
    1. Teflon strip, 750 microns thick; and Teflon tape, 130 microns thick.
    2. High-impact polystyrene or nylon equal to Eel-slip pads as manufactured by Scan-Pac.
    3. High-impact Nylatron.
B. Low-friction materials shall be impervious to moisture.

2.08 SEALANT AND SEALANT BACKING MATERIAL:

A. Cellular Glazing Tapes:
    1. Semi-rigid, adhesive-backed cellular foam tape: ASTM C1281.
    2. An acceptable product is Thermalbond as manufactured by Norton Performance Plastics Corporation.

B. Sealant Compounds:
Sealant compounds shall be neutral-cure silicone, non-staining, matte in color, and specifically intended for the use intended.
1. Structural silicone: ASTM C1184, Type S or M.
2. The following are acceptable sealant products:
   a. DC 995 as manufactured by the Dow Corning Corporation.
   b. DC 795 as manufactured by the Dow Corning Corporation.

C. Sealant Backing Materials:
Preformed foam plastics and synthetic rubbers, compressible, non-gassing, non-staining and compatible with sealants and as recommended by the sealant manufacturer. Backing shall be of the sizes and shapes to suit the various conditions.
1. Open/closed cell extruded polyolefin backer rod: SOF-ROD as manufactured by AET, Inc.
2. Extruded silicone rubber: same as 2.09F.
3. Cellular glazing tape: reference 2.08A

2.09 PREFORMED SYNTHETICS:

A. The particular alloy, compound, and performance characteristics shall be appropriate to the intended function of the preformed synthetic and is subject to approval by the Architect.
B. Base gasket material manufacturers and gasket extruders are subject to approval by the Architect and the Structural Engineer.
C. All materials shall be non-staining and UV stabilized.

2.10 FINISH HARDWARE:

A. Supply and install all finish hardware as required for the OM, as specified hereinafter or as indicated on the Drawings and all other finish hardware that may be required to make the OM complete.
B. All finish hardware shall comply with the requirements of Section 08700 – Finish Hardware.
C. Indicate all finish hardware on shop drawings and submit manufacturer's data sheets and physical samples as specified in Section 1.06 – SUBMITTALS.

2.11 COMPONENTS OF THE WORK:

A. General:
Components shall be manufactured from electroplated galvanized carbon steel, except where indicated otherwise. Substitutions for electroplated galvanized steel may be considered only for those components that are not finished or exposed to the weather.
B. Metal Finish Panels:
1. Powder coated perforated aluminum panels should be fastened to the posts to be concealed from view to the extent possible. Exposed fasteners to be located out of ready view and shall be subject to approval of the Architect and the Structural Engineer.
2. Finish of all powder coated panels to match Architect's sample.

C. Architectural Exposed Structural Steel:
   1. All steel exposed to view in public areas shall be Architectural Exposed Structural Steel and shall be as follows:
   2. Tolerances shall be, as a minimum, consistent with the AISC tolerances for Architectural Exposed Structural Steel, Section 10 of the Code of Standard Practice, except where more stringent tolerances are required by the design.
   3. Tolerances for fabrication and installation shall be half those normally accepted for structural steel.
   4. Lines shall be straight, surfaces flat and without surface imperfections, corners square with uniform, sharp arrises.
   5. All welds shall be ground smooth to match surrounding surfaces, flush welds shall blend with adjacent surfaces.
   6. Surfaces shall be near-white blast cleaned and receive the finish specified herein.

PART 3 – FABRICATION, ASSEMBLY, INSTALLATION AND PROTECTION

3.01 GENERAL:

A. Use no materials, equipment or practices that may adversely affect the functioning, appearance or durability of the completed IGOM Work and related construction.
B. The OM shall be accomplished in compliance with the specified criteria without buckling; opening of joints; undue stress on fasteners, sealants and gaskets; cracking of glass; leakage; noises or other harmful effects.
C. Conform strictly to the materials, finishes, shapes, profiles, sizes, thicknesses, and joint locations required by the Contract Documents.
D. Match all materials to produce continuity of line, texture and color.
E. All work shall be of the highest quality, in accordance with the best trade practices, and performed by skilled workers. All work shall be accomplished to the satisfaction of the Architect.
F. To the fullest extent possible, fabrication and assembly shall be executed in the shop. Work not shop-assembled shall be shop-fitted.
G. All components exposed in the finished work shall be free from warping; oil-canning effects; the telegraphing of welds, studs, and other fasteners; streaks; and tool or die marks.
H. All fabrication of components with edges exposed to view shall be done prior to finishing.

3.02 FABRICATION AND ASSEMBLY:

A. The design of the Ornamental Metalwork shall endeavor to keep site operations to a minimum. Manufacturing, finishing and assembly processes shall, to the extent practicable, be carried-out off-site and under controlled environmental conditions.
B. Assembly procedures to be carried out on-site shall be simple to execute and capable of execution within the time(s) allowed in the Master Construction Schedule.

C. Manufacturer's Standards: Materials, components, and systems incorporated in the Work shall be mixed, applied, installed and otherwise used in strict accordance with the recommended standards and procedures of the respective manufacturers.
D. Storage and Handling: Materials shall be stored in a dry, well-ventilated location. Handling of materials shall be kept to a minimum, and all materials shall be carefully protected from soiling and from condensation or other harmful moisture.

E. Jointing and Reinforcing:
1. Accurately fit and firmly secure all exposed metal joints with metal-to-metal hairline contacts.
2. All work shall be properly reinforced for hardware, anchors and other attachments.
3. All fasteners shall be installed at an approved spacing. Fasteners shall not penetrate gutters and drainage systems.
4. All screws and bolts located outboard of the air-seal shall be UNS S31600 alloy stainless steel.
5. All bolts and screws up to 10 mm in diameter or heavier shall be UNS S31600, UNS S30400, UNS S30300 alloy stainless steel if located inboard of the air-seal.
6. All bolts and screws over 10 mm in diameter or heavier shall be UNS S31600, UNS S30400, UNS S30300 alloy stainless steel, hot-dip galvanized, or cadmium plated if located inboard of the air-seal.
7. No self-drilling fasteners shall be located outboard of the air-seal. Self-drilling fasteners located inboard of the air-seal shall be differentially hardened to maintain a maximum shank hardness of RC35 and shall not be used for primary structure support.
8. All jointing and splicing of members shall be concealed.
9. Exposed Fasteners:
    a. Exposed fasteners shall occur only where expressly permitted by the Architect.
    b. Spacing and location of all fasteners shall be as approved by the Architect.
    c. Where exposed in finished surfaces, fasteners shall be socket-head countersunk type screws, spanner head bolts, or socket head cap screws, as indicated on the Drawings and to the approval of the Architect.
10. All joint sealants shall be concealed from view unless otherwise approved by the Architect. All exposed sealants are subject to the requirements of Item G.5 below.

F. Welding:
1. All welding of steel shall be in accordance with the recommendations of the American Welding Society.
2. Steel welding shall be done by skilled mechanics qualified by test as prescribed in the American Welding Society code and as applicable to the material thickness and type of welded joint on which the welders will be employed.
3. All welding shall be done with electrodes and/or methods recommended by the suppliers of the metals being welded. The type, size, and spacing of welds shall be as shown on the approved shop drawings. Welding materials and methods shall be such as not to cause distortion, discoloration, or result in any adverse effect on the required profiles and finishes of visible surfaces of the OM.
4. All welds located outboard of the air-seal shall be continuous or shall be sealed with an appropriate sealant between intermittent welds to result in a continuous weld/seal.
5. Welding of aluminum alloys and the qualifications of aluminum welders shall be TIG or MIG welding conforming to the requirements of the Aluminum Association “Specifications for Structures of Aluminum Alloys, Aluminum Construction Manual”.
6. Welding of stainless steel shall be by TIG welding or other methods subject to approval. Use double bevel butt welds, backing bars to remove heat, jigging, tack welds and any other measures necessary to minimize distortion.
7. Weld splatter and welding oxides on exposed surfaces shall be removed. All exposed welds shall be finished to match and blend with adjacent parent metal prior to final finish application.
8. Stud welding shall be done by mechanics trained by the manufacturer of the stud setting system. The manufacturer shall develop specific programs and instructions in cooperation with the fabricator to suit the needs of the specific details. The fabricator shall exercise particular care that all recommendations of the manufacturer are closely followed.
9. Visible marks such as telegraphing on finished surfaces due to welding of studs shall not be acceptable.

G. Sealant and Gasket Applications:

1. Sealing mechanisms (sealant and gaskets) shall be provided where indicated on the Drawings or where required for a permanently weathertight installation. The sealing mechanism for each location and use shall be as indicated on approved shop drawings. In those locations where a mechanism is necessary but is not indicated, it shall be of a type recommended by the Trade Contractor and approved by the Architect.
2. The design of all sealed joints shall be in accordance with the recommendations of the sealant and/or gasket manufacturer.
3. Specific alloys, compounds, etc. of gasket materials shall be appropriate for the function intended and are subject to approval by the Architect. All gasket manufactures and suppliers are subject to approval by the Architect and the Structural Engineer.
4. Submit test samples of all substrate materials to the sealant manufacturer for compatibility and peel adhesion testing.
5. All joint sealants shall be concealed from view unless otherwise approved by the Architectand the Structural Engineer. All sealant joints exposed to view shall conform to the following standards:
   a. All sealant beads shall be consistent in dimension with neat, uniform edges.
   b. Mask all adjoining surfaces with tape prior to sealant installation to ensure a neat, uniform and straight edge of bead.
   c. Fill all joints continuously and completely with sealant and tool to form a uniform and neat concave surface.
   d. Carefully remove masking immediately after tooling.
   e. Any work which deviates from the above requirements shall be subject to rejection.
6. Joints and joint surfaces shall be clean, dry and free of any materials that may have an adverse effect on the performance of the sealant and gasket materials.
7. Apply sealants and gaskets under the conditions recommended by the manufacturer(s). All surfaces to receive sealants shall be treated (cleaned, primed or unprimed) in accordance with the recommendations of the sealant manufacturer. Do not use any sealant that has started to set in its container or a sealant that has exceeded the shelf life as published by the sealant manufacturer.
8. Color of all sealants shall be as approved by the Architect and the Structural Engineer based on samples to be examined on site, as requested by the architect.

3.03 INSTALLATION:

A. Prior to the start of installation, inspect the building and verify all conditions and dimensions as being acceptable to receive the Work of this Section. Verify elevations and plan locations of all structural substrates, concrete, and position of embeds and other anchorages for compliance with the requirements.

B. Should any conditions be found, that may prohibit proper execution of the Work, the Trade Contractor shall immediately notify the Architect in writing of these conditions. Installation shall nor proceed until remedial action, acceptable to the Architect and the Structural Engineer has been executed.

C. Installation Tolerances:

Ornamental Metalwork shall be erected plumb, square, level and correctly aligned within the following limitations:

1. Offset from true horizontal, vertical and design location shall not exceed ±2 mm per 4000 mm of component dimension nor ±5 mm overall.
2. Maximum offset from true alignment between abutting components, components intended to be inline, or components separated by less than 75 mm shall not exceed 1 mm.

3. Joint widths as noted in the Contract Documents are the design joint width at an ambient temperature of 35°C. Installation procedures shall be adjusted to take into account the ambient temperature at the time of installation.
4. All tolerances are non-cumulative.

D. Care shall be exercised to properly brace and reinforce prefabricated assemblies against racking during hoisting and installation.

E. Embeds, Anchors and Connections:
1. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide embed layouts, setting diagrams, templates, instructions and directions as required for installation.
2. Anchors and connections shall be provided to fully satisfy their required purpose of adjustability, movement and load transfer.
3. Anchors and connections that do not provide for movement shall prevent such movement by appropriate means.
4. Anchors and connections that are designed for movement shall be of such construction that friction is low enough to allow for such movement without causing buckling and any other damage and without causing binding and noises.
5. Self-drilling, self-threading fasteners shall not be permitted for use into concrete or masonry.
6. Anchorage into masonry construction shall typically be achieved through the use of chemical adhesive anchors intended to provide an adhesive as well as mechanical anchorage into the substrate. Anchorage into reinforced concrete shall typically be achieved through the use of expansion anchors or cast-in embeds.
7. Powder actuated or explosive fasteners shall not be permitted.
8. Self-drilling fasteners shall not be permitted outboard of the air-seal. Self-drilling fasteners located inboard of the air-seal shall be differentially hardened to maintain a maximum shank hardness of RC35.
9. Metal surfaces shall be separated in such a manner that metal does not move on metal. Materials used for this purpose shall be low-friction components, sealants or gaskets as applicable.
10. Connections between different materials, or different alloys of the same metal, shall be designed to accommodate the differential thermal movement of the materials to be connected.
11. All anchors, connections and fixings on the exterior side of the air-seal shall be UNS S31600 alloy stainless steel. Anchors, connections and fixings located inboard of the air-seal shall be UNS S31600, or UNS S30400 stainless steel; hot-dip galvanized; zinc-plated; or cadmium-plated.
12. Avoid excess shimming that may induce additional stress on the fastener. The total thickness (t) of a shim pack shall not exceed a dimension equal to the diameter (d) of the fastener/anchor. Where t>d, the fastener/anchor shall be recalculated to take into account the additional stress from bending on the fastener with the assumption that the shim does not contribute to resistance to fastener bending. Additional stress due to bending shall be added to tension stress and the tension/shear interaction analyzed.
13. Shim packs that only resist compressive forces may be high-impact plastic, Korolath type or equal. Shim pack subject to shear forces shall be doughnut-type stainless steel or hot-dip galvanized steel plates pinned together, or interlocking high-impact plastic shims acting as a monolithic shim.

F. Corrosion Protection:
1. Ensure by design that no metals, including alloys of the same base metal, are placed together in a manner, combination, or location likely to give rise to damage by electrolytic action or other corrosion. In particular, avoid metal to metal contact between aluminum and metals other than an appropriate alloy of stainless steel as per the recommendations of the material manufacturer and to the approval of the Architect and the Structural Engineer. Ensure that dissimilar aluminum alloys in contact with each other are compatible with

each other or are isolated. Any other dissimilar materials are to be treated or protected in such a manner as necessary to prevent corrosive action.

2. Isolation of dissimilar metal surfaces to prevent electrolytic action shall be accomplished by materials which are impervious to moisture and non-absorptive.
3. All steel parts shall receive a protective treatment commensurate with their respective functions and locations. The treatment shall be one or more of those described in Section 2.03 and as approved by the Architectand the Structural Engineer.
4. Where used to the exterior of air-seals, or in any location vulnerable to moisture, all steel components shall be UNS S31600 alloy stainless steel.
5. Field welds on galvanized steel shall be treated with an approved cold galvanizing process (i.e. ZRC). Cold-galvanizing compounds are subject to approval by the Architect. All repair procedures shall comply with the recommendations of ASTM A780.

3.04 PROTECTION, CLEANING AND ACCEPTANCE:

A. Protect the OM from any material, equipment or practices that may impair the functioning, appearance and/or durability of the OM and any other construction.
B. Package and store materials in a manner that will prevent damage, contamination, distortion, breakage or structural weakening. Guardrail assemblies shall be covered with a rigid protection board to prevent damage until building occupation.
C. Replace any material damaged during manufacture, shipping, storage or erection.
D. Protect the installed OM from damage by other trades.
E. Protection materials, such as plastic membrane tapes and adhesive sheeting, shall be UV-resistant and suitable for the intended protection application and protection period.
F. Protection materials shall be installed in a manner that will not trap harmful moisture or otherwise contaminate the Work in any way. Do not leave plastic protection sheeting on metalwork after installation.
G. The Trade Contractor shall submit samples and manufacturer's performance data, as well as application and removal procedures for all protection material.
H. Remove and replace any portion of the OM that has been damaged by other trades. All damaged material shall be promptly removed from the site.
I. Acceptance of the completed installation of the OM requires that the installation be sound, watertight, and free from defects of materials and workmanship.
J. Immediately prior to completion of the Work, completely clean the entirety of the Ornamental Metalwork.
    1. Clean all components of the Work as per the recommendations of the specific product manufacturer.
    2. Clean the OM from the top down in order to avoid staining of cleaned surfaces from cleaning solution residue and run-off.
    3. Clean metals with approved cleaning solutions only and ensure that cleaning solution is completely removed from the surface after cleaning.

END OF SECTION

SECTION 074213

METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes MCM wall panels.

1.3 DEFINITIONS

A. MCM: Metal Composite Material is two sheets of smooth metal continuously thermo-bonded to a solid Fire Retardant (FR) core under precise temperature, pressure, and tension.
B. DBVR: Drained & Back-Ventilated Rainscreen is a system designed to manage and limit water from contacting the air/water barrier and allowing for the subsequent drying within the cavity via ventilation.
C. PER: Pressure Equalized Rainscreen is a system designed to equalize pressure between interior cavities to prevent water from contacting the air/water barrier and allowing for the subsequent drying within the cavity via ventilation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference:
1. Meet with Owner, Architect, Owner's insurer if applicable, MCM panel Fabricator and Installer, MCM sheet manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM panels.
5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
6. Review temporary protection requirements for MCM panel assembly during and after installation.
7. Review procedures for repair of panels damaged after installation.
8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
B. Shop Drawings:
1. MCM system fabricator to provide shop drawings including fabrication and installation layouts of MCM panels; details of edge conditions, joints, panel profiles, corners, attachment assembly, trim, flashings, closures, and accessories.

2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of MCM panel indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. MCM Panels: 12 inches long by actual panel width. Include fasteners, closures, and other MCM panel accessories. Submit custom color samples in paint manufacturer's standard size.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, tests performed by a qualified testing agency.
1. MCM Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1407.14 and IBC 1703.5.
2. MCM System Fabricator's Certified System Tests Reports: Certified system test reports showing system compliance with specific performance or third-party listing documenting compliance code section. Base performance requirements on MCM system type provided.
a. DBVR System: Tested to AAMA 509.
b. PER System: Tested to AAMA 508.
c. NFPA 285.

B. Environmental Product Declaration (EPD): Provide the Product-Specific or Industry-Wide Type III EPD in compliance with ISO 14025.

C. Field quality-control reports.

D. Sample Warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For MCM panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. MCM Manufacturer Qualifications: An entity that has successfully manufactured MCM at a domestically located factory for a minimum of 5 years.

B. MCM Fabricator Qualifications: An entity that has successfully fabricated and assembled MCM panels and approved by the MCM manufacturer.

C. MCM Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by MCM Fabricator.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for MCM fabrication and installation.
1. Build mockup of typical MCM panel assembly including supports, attachments, and accessories.
2. Water-Spray Test: Conduct water-spray test of mockup of MCM panel assembly, testing for water penetration in accordance with AAMA 501.2.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.

B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack MCM panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.
D. Retain strippable protective covering on MCM panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate MCM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Refer to Manufacturer’s standard terms and conditions.
B. Material Warranty: Submit the Manufacturer’s standard form agreeing to furnish fabrication, labor and material to repair or replace MCM that exhibits defects within the specified warranty period.
   1. Coverage Includes:
      a. Delamination of metal bond to the fire-retardant core.
   2. Warranty Period: 10 years from date of Substantial Completion
C. Workmanship Warranty: Submit the Fabricator/Installer’s standard form agreeing to furnish fabrication, labor and material required to repair or replace work which exhibits workmanship defects within the specific warranty period.
   1. Warranty Period: 2 years from the date of Substantial Completion.
D. Warranty on Panel Finishes: Submit the Manufacturer's standard form agreeing to furnish fabrication, labor and material to repair or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Coverage includes:
      a. Color fading more than (5) Delta E units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of the paint to adhere to the bare metal substrate.
   2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide MCM panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330:
   1. Wind Loads: As indicated on Drawings.
   2. Panel Deflection Limit: For wind loads, no greater than 1/60 of the span.
   3. Framing Member Deflection Limits: For wind loads, no greater than 1/175 of the span.
B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. of wall area when tested in accordance with ASTM E283 at a test-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
C. Water Penetration under Static Pressure: No water penetration to room side of assembly when tested for 15 minutes in accordance with ASTM E331 a test-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
D. Thermal Movements: Locate expansion and contraction points to allow for free and noiseless thermal movements from surface temperature changes at a range of 20 deg F to 180 deg F (minus 29 to 82.2 deg C), material surfaces.
E. Fire Propagation Characteristics: MCM wall assembly passes NFPA 285 testing.
F. Rainscreen Cladding Performance:

1. AAMA 508: Water mist or water droplets appearing in less than 5% of the air/water barrier surface, and no continuous streaming at any location on the air/water barrier. Pressure equalization lag time between the cavity and cyclic wind pressure shall not exceed 0.08 sec^2. The maximum differential between the cavity and the cyclic wind pressure shall not exceed 50% of the maximum test pressure.
2. AAMA 509: Dynamic water penetration classification no greater than W1 or 1.0oz/ft^2 and air flow ventilation classification no less than V4 or 6.0 cfm/ft^2.

2.2 MCM WALL PANELS

A. MCM Wall Panel Systems: Provide -shop formed and assembled MCM panels formed into profiles for the installation method indicated and per the construction drawings. Include attachment assembly components**,** panel stiffeners, and accessories required.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide ALUCOBOND® PLUS manufactured by 3A Composites USA, Inc., or comparable product by:
      a. Arconic Architectural Products.
      b. Mitsubishi Chemical America.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch thick aluminum sheet facings.
   1. Panel Thickness: 4mm (0.157”)
   2. Core: Fire retardant.
   3. Exterior Finish: Acceptable coating resins are polyvinylidene difluoride (PVDF), fluorinated ethylene vinyl ether (FEVE), super-durable polyester (SDP), siliconized polyester (SMP) & anodized. The number of coats and film thicknesses shall comply with the specified warranty period and specified basis-of-design finish(es):
      a. Basis-of-design finish(es):
         1). Finish 1: MZG Gray Mica.
         2). Finish 2: JRL Gray Metallic.
   4. Peel Strength: 22.5 in-lb/in when tested for bond integrity in accordance with ASTM D1781.
   5. Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with ASTM E84.

C. Attachment Assembly Components: Formed from extruded aluminum or other compatible material per the construction drawings and in compliance with all required performance testing.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub-framing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide Fabricator's standard sections as required for support and alignment of MCM panel system.

B. Panel Accessories: Provide components required for a rainscreen panel system including trim and flashing as indicated on the constructions drawings. Match material and finish of MCM panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, and parapet caps.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide ALUCOBOND® AXCENT™ manufactured by 3A Composites USA Inc., or comparable product by one of the following:
      a. Arconic Architectural Products.
      b. Mitsubishi Chemical Composites.
   2. Aluminum Trim: Formed with minimum 0.040-inch thick, coil-coated aluminum sheet unless otherwise indicated on the construction drawings.
   3. Basis-of-design Finish: To match MCM wall panel system unless otherwise indicated in the construction drawings.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish MCM panels and accessories to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensions as indicated on the construction drawings.

B. Fabricate MCM panel joints to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensions as indicated on the construction drawings.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces provided by others is acceptable. Variation in appearance from different production batches of finish effects including but not limited to anodized, brushed coil, mica flake, metallic flake, and texture is expected.

C. Allowable finishes for MCM Panels and Accessories: See basis-of-design finish selection and warranty requirements. Prepare, pretreat, and apply coatings to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Coil Coated Finishes:
      a. PVDF Fluoropolymer: AAMA 2605. Containing not less than 70 percent PVDF resin by weight in color coat.
      b. FEVE Fluoropolymer: AAMA 2605. F 100 percent fluorinated ethylene vinyl ether resin in color coat.
      c. SDP Super-durable Polyester: AAMA 2605. Containing carboxyl or hydroxyl functional resin in the color coat.
      d. SMP Siliconized Polyester: AAMA 2604. Containing silicone-modified, polyester-enamel in the color coat. .
   2. Anodized Finish
      a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
      b. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM wall panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating MCM panels to verify actual locations of penetrations relative to seam locations of MCM panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install sub framing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and MCM panel manufacturer's written recommendations.

3.3 MCM PANEL INSTALLATION

A. General: Install MCM panels in accordance with Fabricator's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving MCM panels.
   2. Flash and seal MCM panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by MCM panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as MCM panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support MCM wall panels, including sub girts, perimeter flashing components, , and panel clips as indicated in the construction drawings.

E. Panel Installation: Attach MCM wall panels to supports at locations, spacings, and with fasteners to achieve performance requirements specified.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete MCM panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by MCM panel Fabricator; or, if not indicated, provide types recommended in writing by MCM system Fabricator.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, or SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 PROJECT CONDITIONS

A. Substrate Tolerances: The General Contractor is responsible for providing a substrate with a tolerance of 1/4 inch in 20.0 feet (6mm in 6m), on level, plumb, and location control lines as indicated and within 1/8 inch (3mm) offset adjoining faces of alignment of matching profiles.
B. Field Measurements: Verify locations of wall framing members and wall opening dimensions by field measurements prior to the fabrication of the MCM system. Field measurements to be acquired once all substrate materials and adjacent materials are installed to use as-built data to submit “As Built Shop Drawings” with required adjustments to panel dimensions and layouts.

3.5 FIELD QUALITY CONTROL

A. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
B. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as MCM panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of MCM panel installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.
B. After MCM panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
C. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 075200

MODIFIED BITUMINOUS ROOFING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Modified bituminous membrane torch applied (heat welded) roofing.
B. Modified bituminous membrane hot mopped applied roofing.
C. Modified bituminous membrane cold adhesive applied roofing.
D. Modified bituminous membrane Self adhered roofing.
E. Modified bituminous membrane mechanically attached.
F. Roof Insulation.

1.2 RELATED SECTIONS

A. Section 03510 – Cast Concrete Decking: Decking and decking substrate preparation
B. Section 05300 - Metal Decking: Decking and decking substrate preparation.
C. Section 06100 - Rough Carpentry.
D. Section 06114 - Wood Blocking and Curbing: Wood nailers and cant strips.
E. Section 07220 - Insulation Board: Insulation and fastening.
F. Section 07620 - Sheet Metal Flashing and Trim: Weather protection for base flashings.
G. Section 07710 - Manufactured Roof Specialties: Counter flashing gravel stops, and fascias.
H. Section 07724 - Roof Hatches: Frame and integral curb; Counter flashing.
I. Section 08620 - Unit Skylights: Skylight frame and integral curb and counter flashing.
J. Section 08630 - Metal-Framed Skylights: Skylight frame and integral curb and counter flashing.
K. Section 08950 - Translucent Wall and Roof Assemblies: Counter flashing
L. Section 08960 - Sloped Glazing Assemblies: Counter flashing.
M. Section 15120 - Piping Specialties: Roof Drains, Sumps.

1.3 REFERENCES

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
B. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
C. ASTM D312 - Standard Specification for Asphalt used in Roofing.
D. ASTM D1970 - Specification for Sheet Materials, Self-Adhering Polymer Modified Bituminous, Used as Steep Roofing Underlayment for Ice Dam Protection.
E. ASTM D6162 - Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
F. ASTM D6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
G. ASTM D6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
H. ASTM D6222 - Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
I. ASTM D6223 - Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
J. ASTM D6757 - Standard Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep-Slope Roofing.
K. ASTM D7897 - Standard Practice for Laboratory Soiling and Weathering of Natural Exposure on Solar Reflectance and Thermal Emittance.
L. NRCA - The NRCA Roofing and Waterproofing Manual. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.

M. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
N. ANSI-SPRI ES-1 Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.
O. UL - Fire Resistance Directory.
P. FM Approvals - Roof Coverings.
Q. FBC - Florida Building Code.
R. Miami-Dade Building Code Compliance - N.O.A. (Notice of Acceptance)

1.4 CODE AND TEST REQUIREMENTS

A. Perform work in accordance with all federal, state and local codes.
B. Windstorm Classification: Roofing system, which will achieve the required uplift resistance as calculated in accordance with the most current revision of ASCE 7-16 or determined by the Design Professional, local Code Agency, or Authority having Jurisdiction (AHJ). .
C. Roof system to be tested in compliance with the following codes and test requirements:

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions.
C. Shop Drawings: Shop drawings including installation details of roofing, flashing, fastening and insulation, including notation of roof slopes and fastening patterns of insulation and base modified bitumen membrane, prior to job start.
D. Design Pressure Calculations: Design pressure calculations for the roof area in accordance with ASCE 7-16 and local Building Code requirements. Include a roof system attachment analysis report, certifying the system's compliance with applicable wind load requirements before Work begins. Report shall be signed and sealed by a Professional Engineer registered in the State of the Project who has provided roof system attachment analysis for not less than 5 consecutive years.
E. Verification Samples: As required. For each modified bituminous membrane ply product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
F. Manufacturer's Field Reports: As required.
G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.
B. Manufacturer Qualifications: Company specializing in manufacturing products specified with ten years documented experience.
C. As an ISO 9001:2015 Certified Company, Polyglass provides quality products worldwide.
D. Dependent upon the type of warranty requested or specified, roof observations may be required. Polyglass reserves the right to conduct roof observations to ensure quality of installation.
E. Polyglass provides installers assistance with a qualified team of technical field representatives. Please contact Technical Services or your local sales representative for information regarding the Technical Representative assigned to your region.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing Work of this section.
B. Review installation procedures and coordination required with related Work.
C. Inspect and make notes of job conditions prior to installation:
   1. Record minutes of the conference and provide copies to all parties present.
   2. Identify outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.

3. Installation of roofing system shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ensure all materials are stored in a manner which prevents them being exposed to moisture.
B. Materials should be examined when received. Damaged or unlabeled materials should not be used.
C. Materials must be stored in a dry area with adequate ventilation. Care should be taken to only remove stored materials that can be installed in a reasonable amount of time. All excess materials must be kept in storage.
D. Rolls shall be stored in an upright position with selvage edge up on pallets.
E. Prior to beginning installation, remove all roll wrapping tape by cutting carefully and not ripping the material.
F. Polyglass does allow double stacking of pallets of membranes with the use of slip boards. Please see the Technical Bulletin online at www.polyglass.us for Rotation and Storage of Roll Products.
G. Polyglass self-adhered membranes to be stored at room temperature whenever possible and in an upright position on a flat surface. Avoid storing out of packaging for prolonged periods, especially above 88°F (31°C), in direct sunlight. Do not take the roll out of the packaging until it is ready for application. Refer to technical bulletins found at www.polyglass.us for more instruction on storage and handling.
H. Polyglass ADESO® membranes shall remain stored in boxes or wraps until time of application.
I. Polyglass Cold Applied Cements, Adhesives and Mastics shelf life is typically 18 months, if stored in original unopened containers – between 40°F–100°F (4°C– 38°C).
J. All containers should be sealed when not in use.

1.9 COORDINATION

A. Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.10 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY

A. Warranty Type: Roofing System
B. Warranty Form: Low Slope
C. Warranty Term: 20 years from date of acceptance
D. Roofing System Warranty: Upon completion of Work. Written and signed, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installing contractor, the manufacturer shall provide the Owner, at Manufacturer's expense, with no dollar limit, the labor and material necessary to return the defective area to a watertight condition.
E. Contractor is to guarantee all work against defects in materials and workmanship for a period indicated following final acceptance of the Work.
   1. Warranty Period: minimum of 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Polyglass USA, Inc., which is located at: 1111 W. Newport Center Dr.; Deerfield Beach, FL 33442; Toll Free Tel: 888-410-1375; Tel: 954-233-1330; Fax: 954-418-4453; Web: www.polyglass.us; Email: request info (pgmarketing@polyglass.com).
B. Substitutions: Not permitted.

2.2 MODIFIED BITUMINOUS ROOFING MEMBRANE

A. Base Sheet:
1. Elastoflex SA V
a. ASTM: D1970; D6163 - Self-Adhering Polymer Modified Bituminous, Steep Roofing High Temperature Underlayment; Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Fiberglass Reinforcements
b. Reinforcement: Fiberglass
c. Type: I
d. Thickness: 80 (mils) [2.0 (mm)]
2. Method of application: Self Adhered

B. Cap Sheet:
1. Elastoflex S6 G
a. ASTM: D6164 - Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
b. Reinforcement: Polyester
c. Type: I
d. Thickness: 160 (mils) [4.0 (mm)]
2. Method of application: Heat Weld

2.3 FLASHINGS

A. WALL FLASHINGS
1. Same as Field: Minimum of 1 ply of base/interply as reinforcement and cap sheet for all flashing systems.

B. PENETRATION FLASHINGS
1. Liquid Flashings
a. Polyflash 1C: one-component, moisture-cure silane modified polyurethane, white flashing compound.
2. Must be installed in 3-course fashion using PolyBrite Reinforcing Polyester Fabric.

2.4 FASTENERS

A. Fasteners and Plates: Provide FM Approved fasteners and plates and other devices as required to suit the system specified.

B. Wood: Roofing nails of galvanized or stainless steel, of length to penetrate the wood by at least 3/4 inch (19 mm) on flashings and parapet walls.

C. Masonry: Nail-in expansion type device with zinc body, plated steel nail, and mushroom head or approved equal and of length to embed into the masonry a minimum of 1 inch (25 mm).

D. Insulation: Mechanical fasteners for securing of insulation to decking shall be approved by the insulation manufacturer for the system specified and shall be FM Approved and be in compliance with Appendix "E" of FM 4470 for corrosion resistance.
1. Use the same brand fastener throughout the work.
2. Provide the number of fasteners and layout as recommended by the manufacturer and per FM Approvals.
3. Determine length of fastener by the thickness of the decking and any fill and the thickness of the insulation. Fasteners shall be of sufficient length to achieve a minimum of 1 inch (25 mm) penetration.

E. Pre-Assembled Fastener/Plate Combination: Case hardened carbon steel and use specific head, shank and thread diameters, point types and head styles meeting building code and FM approvals for corrosion and simulated wind uplift criteria requirements.
1. Fasteners are designed for the attachment of insulation and membrane to steel (18-24 gauge), wood, and structural concrete.
2. Provide to meet FM requirements, fastener shall penetrate the steel deck 3/4 inch (19 mm). Minimum penetration is 1 inch (25 mm) in wood, 3/4 inch (19 mm) through wood that is less than 3/4 inch (19 mm) thick and 1-1/4 inches (32 mm) in concrete.

2.5 PRIMER

A. Asphalt Primer: Polyglass PG100 Asphalt Primer conforming to ASTM D41.
   1. Applied on all dissimilar materials except insulation.
   2. General purpose penetrating asphalt primer used to promote adhesion prior to the application of hot-mopped, cold-applied, and self-adhesive membrane systems as well as roof cements, mastics, and asphalt-based adhesives.

2.6 ASPHALT

A. Certified in full compliance with requirements of Type III or IV asphalt listed in Table 1, ASTM D312. Each container, or bulk, shipping ticket shall indicate the equiviscous temperature (EVT), the finished blowing temperature (FBT), and the flash point.

2.7 MISCELLANEOUS

A. Adhesive/Sealant:
   1. Polyglass PG 500 Modified Cement. Meets or exceeds the requirements of ASTM D4586 Asphalt Roof Cement Type I.
   2. Polyglass PolyPlus 50 Premium MB Flashing Cement. Meets or exceeds the requirements of ASTM D4586 Asphalt Roof Cement Type I.
   3. Polyglass PolyPlus 35 or PG 350 Modified Adhesive. Meets or exceeds the requirements of ASTM D3019 Type III Lap Adhesion.
B. Insulation Adhesive:
   1. Approved low-rise foam adhesive.
C. Roofing Insulation: As specified in Section 07220.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Inspect and approve the deck condition, slopes and fastener backing if applicable, parapet walls, expansion joints, roof drains, stack vents, vent outlets, nailers and surfaces and elements.
C. Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.
D. If substrate preparation and other conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 SUBSTRATE/PREPARATION

A. Polyglass is not responsible for design, selection, or performance of the deck. Roof decks are to be designed and constructed as per the deck manufacturers specifications and shall be suitable to receive a Polyglass roofing assembly.
B. Prior to roof construction, the acceptance of the suitability of the substrate shall remain the responsibility of the applicator and/or the Authority Having Jurisdiction.
C. Field verification of the suitability of the substrate shall include fastener withdrawal resistance, moisture content, as well as the overall condition of the substrate. Testing standards such as ANSI/SPRI FX-1 (withdrawal resistance), ANSI/SPRI 1A- 1 (adhesion testing), as well as ASTM D4263 (surface moisture testing over concrete) shall be applied when assessing the condition of the substrate.
D. Re-cover application may require the use of moisture scans to verify the moisture content of the assembly that currently in place.
E. GENERAL: Clean surfaces thoroughly prior to installation.
   1. Prepare surfaces using methods recommended by manufacturer for achieving the best result for the substrate under the project conditions.
   2. Fill substrate surface voids that are greater than 1/4 inch (6 mm) wide with an acceptable fill material.

3. Roof surface to receive roofing system to be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
4. Wherever necessary, surfaces to receive roofing materials are to be power broomed and vacuumed to remove debris and loose matter prior to starting work.
5. Do not apply roofing during inclement weather. Do not apply roofing membrane to damp, frozen, dirty, or dusty surfaces.
6. Fasteners and plates for fastening components mechanically to the substrate shall provide a minimum pull-out capacity of 300 lb. (1334 N) per fastener. Base or ply sheets attached with cap nails require a minimum pullout capacity of 40 lb. (178 N) per nail.
7. Prime decks where required, in accordance with requirements and recommendations of the primer and deck manufacturer.

F. STRUCTURAL CONCRETE:
1. Decks shall me a minimum compressive strength of 2,500 psi with a minimum thickness of 4" (10 cm).
2. The surface is to be smooth, and free of ridges, sharp edges, and irregular surfaces.
3. The underside of the concrete deck must remain unobstructed to allow for the escape of moisture. This would include the applications of items such as paint, spray fireproofing etc.
4. Concrete decks typically require a minimum of 28 days cure time. Evaluation of determination of moisture content should be in accordance to ASTM D4263 (Plastic Sheet Method).
5. Field uplift resistance for adhesive applications is recommended as per ANSI/SPRI 1A-1.
6. Primers applied to the deck, when applied, must be dry prior to application of adhesives.
7. Cracks greater than 1⁄8" (3 mm) shall be filled or treated as per the direction of the deck manufacturer.

G. Other Deck Types: Contact Polyglass for recommendations in any situation which involves other deck types, new or unusual deck construction.

3.3 INSTALLATION

A. INSULATION INSTALLATION AND ATTACHMENT:
1. Incorrectly installed insulation can lead to roof system loss (blow-offs) and is the responsibility of the insulation installer, not the roof membrane manufacturer.
2. Polyglass does not warrant against improperly attached insulation or insulation failure caused by incorrect application.
3. All joints between layers should be staggered when multiple layers of insulation are installed.
4. Insulation shall be kept dry at all times. Install only as much insulation as can be covered with completed roofing membrane before the end of the day’s work (or prior to onset of inclement weather).
5. Edges shall butt tightly, and all cuts shall fit neatly against adjoining surfaces to provide a smooth overall surface. Gaps of greater than 1⁄4" (6 mm) width shall be filled with insulation.
6. Install tapered insulation around roof drains and penetrations to provide adequate slope for proper drainage.
7. Mechanically attached insulation shall be fastened in accordance with Factory Mutual (FM) Approvals requirements for the applicable geographic Zone with the required number (and type) of fasteners and plates. Exception: where Polyglass requirements are more stringent than Factory Mutual (FM) Approvals or third-party manufacturers, Polyglass requirements shall be followed.
8. When asphalt or foam adhesive attachment is selected by the project designer, the proposed insulation shall be compatible with the roof substrate, the proposed bitumen and the requirements of the specific Polyglass membrane. NOTE: Expanded polystyrene (EPS) materials shall not be installed with hot bitumen products.
9. • Maximum 4' × 4' (1.2 m × 1.2 m) insulation boards can be attached with hot asphalt.
10. • Asphalt for insulation attachment shall meet ASTM D312 Type III or IV criteria, as dictated by the roof slope or other design conditions.

Install modified bitumen membranes and flashings in accordance with manufacturer's instructions and with the recommendations provided by the National Roofing Contractors Association’s Roofing and Waterproofing Manual, the Asphalt Roofing Manufacturers Association, and applicable codes.

Commence installation of the roofing system at the lowest point of the roof (or roof area), working up the slope toward the highest point. Lap sheets shingle fashion so as to constantly shed water. For further information contact Polyglass Technical Services. Follow the recommendations for the specific type of material and layer as outlined below, or as specified. Type II standards, are acceptable for Polyglass roofing systems and should be appropriately installed in a manner approved for the specific product, e.g. fully adhered as self-adhered or with asphalt/or cold adhesive, heat-welded or mechanically attached (per industry standard fastening pattern) as applicable, and in accordance with specifications.

B. BASE AND PLY SHEET INSTALLATION:
   1. Install in a manner approved for the specific product, e.g. fully adhered as self- adhered or with asphalt adhesive, torch applied or mechanically attached.
   2. Base or Inter-ply side laps are to be 3 inch (76 mm) minimum and usually delineated by a “lay line” for mopped, torch or mechanically attached application. End laps are typically 6 inches (152 mm) in all cases.

C. POLYGLASS APP & SBS HEAT-WELDED MEMBRANES, APPLICATION OF HEAT-WELDED BASE/INTERPLY SHEETS

Polyglass APP or SBS heat-welded base or interply sheet membranes are intended to be used as a base or interply sheet in new or re-roof applications. Polyglass APP or SBS base or interply sheets may be applied directly to non-combustible substrates and require the installation of a compatible granulated cap sheet or approved roof coating to complete the roofing system.

   1. Apply over clean, dry, dust and debris-free substrates. Prime concrete decks and required substrates prior to application with PG 100 Fast-Drying Asphalt Primer. Consult Polyglass Technical Services if alternate primer is allowed.
   2. When re-roofing, remove all prior roofing materials down to a clean debris-free substrate and properly close-off all abandoned roof penetrations.
   3. Concrete or steel decks shall be designed with proper expansion devices.
   4. Wood decks shall have all joints blocked and properly supported.
   5. Ensure the fire rating of the assembly over any combustible substrate.
   6. Ensure the installation of the membrane does not prevent the ventilation of existing construction.
   7. Do not apply over shingles or any granulated surface.
   8. While installing Polyglass APP or SBS heat-welded base or interply sheet membranes:
      a. Start at the low point of the roof.
      b. Unroll the material and allow to relax.
      c. Install with traditional heat-welding roofing techniques ensuring proper heating of the roofing material as not to expose the reinforcement.
      d. Do not heat the substrate.
      e. Position successive rolls providing a minimum 6" (15 cm) end lap and 3" (7.5 cm) side lap. Asphalt bleed out shall be 1⁄4"– 3⁄8" (6 mm–10 mm) on all seams.
      f. It is suggested but not mandatory that laps shall be rolled with a 6" (15 cm) wide roller immediately after heat welding.
   9. Details and flashing may be installed using Polyglass APP or SBS heat- welded base or interply sheet membranes with heat-welding techniques. Do not use cold adhesives or hot asphalt. Check project details for proper installation requirements.

D. APPLICATION OF HEAT-WELDED CAP SHEET

Polyglass APP or SBS heat-welded cap sheet membranes are intended to be used as the primary weathering surface in new and re-roof applications. Polyglass APP or SBS heat-welded cap sheet membranes are to be applied as the uppermost layer of a multi-ply roof system over a compatible Polyglass base and/or interply sheet. Polyglass APP or SBS heat-welded cap sheet membranes may be applied directly to certain noncombustible substrates.

   1. Apply over clean, dry, dust and debris-free substrates. Prime concrete decks and required substrates prior to application with PG 100 Fast-Drying Asphalt Primer. Consult Polyglass Technical Services if alternate primer is allowed.

2. When re-roofing, remove all prior roofing materials down to a clean, dust free substrate. Remove unused or abandoned through-roof penetrations.
3. All substrates shall be designed with proper expansion devices.
4. Wood decks shall have all joints cross blocked and/or properly supported.
5. Installation of the membrane should not adversely affect the ventilation of existing construction.
6. Do not apply directly to existing shingles or other unacceptable roof coverings.
7. While installing Polyglass APP or SBS heat-welded cap sheet membranes:
   a. Start at the lowest point of the roof.
   b. Unroll the material and allow it to relax as membrane is positioned prior to installation.
   c. Install with traditional heat-welding roofing techniques ensuring proper heating of the roofing material.
   d. Do not overheat to expose or compromise the reinforcement.
   e. Position successive rolls using the 5" (13 cm) FASTLap at the end of the rolls, where applicable (only premium Polyglass membranes have FASTLap), or at the granulated endlap. Bleed out of asphalt when heat welding the seam should be 1⁄8" –1⁄4" (3 mm–6 mm) (typical all seams).
   f. Laps may be lightly rolled with a 4"–6" (10 cm–15 cm) wide roller to ensure lap is fused.
8. Details and flashings may be installed using heat-welding techniques. Do not adhere using cold adhesives or hot asphalt. Refer to manufacturer's published details for proper design and installation of detail work.

E. COLD WEATHER INSTALLATION

Polyglass advises against installing modified bitumen membranes at temperatures lower than 40°F–45°F (4°C–7°C) (wherever practicable). Where work is unavoidable at such temperatures, we recommend the following precautions be taken:

1. Take extra care during cold weather installation (Below ambient temperatures of 40°F–45°F (4°C–7°C), whereas ambient temperatures are affected by wind, humidity, etc.), to ensure adequate bonding is achieved between the surfaces to be joined. This applies to both material seam welds and adhesion of the applied product to the appropriately prepared substrate (substrate can be affected by such temperature constraints as well).
2. In addition, unrolling of cold materials, under very low ambient conditions must be avoided to prevent the likelihood of unnecessary stress cracking. The rolls must be at least 40°F (4°C) at the time of application. Should the membrane roll become stiff or difficult to install, it should be replaced with a new roll from the storage area.
3. To prevent the aforementioned situations and to ease the progress of installation under unfavorable conditions we recommend the following procedures:
   a. The general recommendations of the National Roofing Contractors Association (NRCA) and Asphalt Roofing Manufacturers Association (ARMA) should be taken into account and will be helpful.
   b. Remember that wind chill will have an effect on the application temperature.
   c. Ensure that membrane is only installed to properly dry, clean and primed (where necessary) surfaces as required by the specifications.
   d. Store membrane, until immediately prior to installing the roll. Minimum ambient temperature of the storage area should be 55°F–60°F (13°C– 15°C).
   e. Once rolls of material are taken from the temperature controlled storage area, install before the temperature of the material drops below 40°F– 45°F (4°C–7°C).

The following application specific recommendations should be followed:

1. SELF-ADHERED APPLICATION
   a. For temperatures between 25°F–60°F (-4°C–16°C), use Polyglass' Elastoflex SA V Polar Base and Elastoflex SA P Polar Cap; ADESO® Self-Adhered membranes for cold weather application.
2. HEAT-WELDED APPLICATION

a. The use of shielded “dragon-wagons”, or moveable, flame-resistant wind shields can also be of great help in the effort to keep all surfaces and materials at a suitably warm temperature during heat-welding.

3. HOT MOP APPLICATION
   a. Asphalt cools and thickens more quickly once removed from the heat source (tanker or kettle) and will not flow well, or give a uniform application rate. The following special precautions should be taken:
   b. All asphalt handling equipment should be insulated in order to minimize the drop-in asphalt temperature.
   c. For mop applied membranes, asphalt must be at least 400°F (204°C) (with a target temperature of 425°F (218°C)) or 20°F above the EVT (Equiviscous Temperature), whichever is higher, at the point of application.
   d. If minimum asphalt temperature of 400°F (204°C) cannot be maintained at the point of application, work should be discontinued.
   e. Never overheat asphalt to compensate for cold weather conditions.
   f. Mopping should not progress more than 5'–7' (1.5 m – 2.1 m) in front of the roll at any time.
4. COLD PROCESS APPLICATION
   a. Cold process adhesives may become increasingly viscous and difficult to apply below 50°F (10°C). In such cases, extra care should be taken to ensure that the adhesives are applied at the proper rate and that humidity conditions are not conducive to condensation at the adhesive- membrane interface. Refer to Polyglass Product Sheets at www.polyglass.us for product specific cold weather application details. Do not proceed with application if inclement weather threatens. When temperatures are cold, store product in a heated area overnight.

F. VAPOR RETARDERS
1. Adequate moisture vapor control is recommended (when appropriate) as a lack thereof may result in the accumulation of moisture in the roofing assembly.
2. An analysis of dew point and vapor flow should be assessed during an initial project design for the building as well as for re-roofing and re-cover applications as they can alter existing vapor flow.
3. In general, vapor retarders may be required when high interior relative humidity is present. The condition is typically seen with food processing facilities, swimming pools, paper mills, laundry facilities, etc.
4. Vapor retarders are sometimes referred to as temporary or secondary roofs.
5. The necessity for use of a vapor retarder is the responsibility of the design professional and should be reviewed and approved by the building owner. The type, location and method of application is also to be determined by the design professional.
6. The National Roofing Contractors Association (NRCA) as well as the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) may be referenced for recommendations on the necessity of a vapor retarder.

G. SPECIAL APPLICATIONS
1. Polyglass roofing assemblies are sometimes selected for installation over buildings that include unique environments and are deemed special purpose. These would include cold storage facilities, pools, as well as partially enclosed and open buildings such as hangars.
2. These should be carefully reviewed as they pose design and building conditions such as elevated moisture or humidity, unusually elevated or lowered temperatures, and elevated pressure conditions.
3. Special applications also include overburden or plaza deck assemblies. These typically include the addition of additional materials for protection of the newly installed roof.
4. Technical Services should be contacted prior to these installations.

H. DRAINAGE
1. Adequate drainage is required for a well-functioning low-slope roof system. The minimum recommended slope is 1⁄4" (6 mm) per foot.
2. Absence of proper drainage often results in “Ponding”. It is defined by the National Roofing Contractors Association (NRCA) as water that has not dissipated from the roof within 48 hours.
3. Ponding water negatively affects the membrane and can result in premature deterioration, and is not covered by Polyglass warranties.

4. The ideal structural roof deck is designed to provide adequate slope and drainage. When the roof deck has not be constructed to provide proper slope and drainage, the use of tapered insulation is required.
5. Primary and secondary drains shall be of sufficient number and diameter and located so as to provide adequate drainage of the entire roof surface.
6. The adequacy of drainage provisions, placement, sizing and/or number of drains required is the responsibility of the design professional. Drainage conditions should meet the requirements of codes as well as standard industry recommendations.

I. CANTS

1. Cant Strips are required at all horizontal/vertical intersections. They may be mechanically fastened or adhered to the substrate depending upon the deck type.
2. Material type of Cant strip is dependent upon the application method of the roofing assembly. Hot asphalt applied systems may utilize Perlite (conforming to ASTM C728) or wood fiber (conforming to ASTM C208). Heat welded flashing assemblies require the use of Perlite only. Self-Adhered flashing applications are recommended to include wood Cant strip (primed).
3. Roofing assemblies that do not include a Cant must incorporate the use of PolyFlash® 1C One Part Flashing Compound with reinforcement at the horizontal and vertical transition. Please contact Polyglass Technical Services for details on this application.

J. WOOD NAILERS

1. It should be noted that both wood nailers and blocking materials are deemed as a component of the structure – not the roofing assembly. However, wood nailers are critical to the success of a well-performing roof.
2. Care for selection of proper lumber used for nailers is important to ensure the selection of the appropriate type and level of corrosion resistance for fasteners.
3. All nailers should be installed as per Factory Mutual (FM) LPDS 1-49 “Perimeter Flashing”.
4. ANSI/SPRI ES-1 should also be referenced for edge metal and parapet wall top conditions to ensure the installation of the nailer materials/attachment to resist calculated wind loads.

K. EXPANSION JOINTS/AREA DIVIDERS

1. Expansion joints are part of the building, considerations such as design and location must be taken at the time of original building design by design professionals and reviewed by the building owner. The purpose of the expansion joint is to minimize stress on the building from movement.
2. Per typical flashing details, expansion joints must me extended a minimum of 8" (20 cm) above the roof surface on curbs. Sheet metal caps or flexible expansion joint covers are used at the top surface of the expansion joint.
3. Expansion joints must be located so as the typical drainage flow is not blocked.
4. Expansion joints are continuous along the break in the structure. They shall not be terminated short of the end of the roof deck.

L. AREA DIVIDERS

1. Area dividers can be similar to but are not considered expansion joints.
2. Typical uses for dividers are to section off roof sections which were not included in original building design/construction. They can relieve stresses in an existing roofing system, and can server as a separator between two dissimilar roofing materials.
3. Area dividers are typically capped with a coping cap style sheet metal detail.

M. MEMBRANE FLASHINGS

1. Membrane flashings and their locations are particularly volatile and are most susceptible to moisture penetration. Proper installation at these locations is critical to the integrity of the roofing assembly.
2. Flashings, or, “Base Flashing”, are locations on the roof whereby the field of the roof (horizontal surface) intersects with a wall, curb, penetrations (vertical surfaces), etc.
3. Membrane flashings entail the installation of two (2) plies of membrane at flashing locations. The products associated with the flashings may utilize same plies used for the overall roofing assembly.
4. Flashing locations that include irregularly shaped penetrations, low flashing clearance heights, or items too close to be properly flashed with membrane may be treated with PolyFlash 1C. Contact Technical Services for more information.
5. Minimum flashing height is 8" (20 cm) and the maximum flashing height is 24" (61 cm).

6. Base flashings shall me mechanically fastened at the top edge and terminated with a proper termination bar and counterflashing.

N. WALKAWAYS AND PROTECTED MEMBRANES

1. Walkways help protect the membrane from damage due to routine rooftop service traffic. Walkways may consist of an additional layer of similar Polyglass membrane of a contrasting color granulated surface, or another approved walkway system. The following are typical roof locations that utilize walkways:
2. All roof access points (ladders, hatches, doorways, etc.).
3. Areas subjected to traffic in excess of one monthly visit.
4. Areas with high pedestrian traffic or subject to frequent maintenance operations.
5. In addition to typical locations requiring walkways, the walkway material may also be applied beneath rooftop equipment such as blocking to support gas/plumbing lines, and small non curb mounted HVAC (or other) equipment placed on wood sleepers.

O. SAFETY AND HEALTH

Strict Safety and Health precautions are necessary at all times. Please read, understand and follow all instructions on labels and packaging as well as any applicable industry standards and regulations. See also all relevant sections above. All volatile, or potentially volatile, materials such as primers, gas, cleaners, etc., shall be kept away from all ignition sources (e.g. flames, torches, fire, sparks, etc.). Consult product container labels and Safety Data Sheets for specific safety instructions. The application of those products installed with hot asphalt or torch may result in burns and other physical injury. Surfaces which contact the melted bitumen or torch may ignite. The installer should take utmost care when using hot materials such as asphalt or when heat-welding any product. This is especially important when there may be a danger of contact with materials which may smolder, such as cellulose and wood materials, wood fiber, etc. or flammable or highly flammable solvents or chemicals. Polyglass membranes may present a slip and fall hazard. This risk is increased when wet or icy conditions exist. Adequate precautions should be taken when working. Manufacturer recommends the use of OSHA approved fall protection for project conditions.

COLD APPLIED:

1. DO NOT HEAT WITH AN OPEN FLAME.
2. Clean equipment and over-spray with water.
3. Clean hands with waterless hand cleaner.
4. Application tools and equipment can be cleaned with odorless mineral spirits solvent. Recirculate through lines and spray equipment guns until residual coating is removed.
5. DO NOT USE WATER OR RECLAIMED SOLVENTS.

P. LIMITATIONS

1. Polyglass membranes should never be applied directly to TPO, EPDM, PVC, or other single ply membranes.
2. Polyglass Cold Applied membranes are not to be used with organic saturated felts.
3. Not to be installed over or under polystyrene insulation.

Q. Surface Coatings: Apply roof coatings in strict conformance with the specific manufacturer's recommended procedures.

R. Provide any corrections to bring the roofing installation into conformance with Polyglass USA, Inc. requirements.

3.4 FIELD QUALITY CONTROL

A. Inspection: Manufacturer shall conduct field observations as deemed necessary by Polyglass for projects requiring Polyglass Roofing Systems Warranty. The number and frequency of field observations shall be as required by Polyglass USA, Inc. Technical Services Department.

B. Contractor shall correct any deficiencies observed by Polyglass Technical Services to bring the roofing installation into specification conformance with Polyglass USA, Inc. warranty requirements.

3.5 CLEANING

A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
B. Remove asphalt markings from finished surfaces.
C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.6 PROTECTION

A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.
B. Protect exposed surfaces of finished walls with tarps to prevent damage.
C. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.
D. In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.
E. Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

END OF SECTION

SECTION 07 65 00

FLEXIBLE FLASHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Laminated stainless steel fabric flashing, non-asphaltic, as indicated on the drawings.

B. Related Requirements:
1. Section 01 33 00- Submittal Procedures.
2. Section 01 45 80- Testing Laboratory Services.
3. Section 01 60 00- Product Requirements.
4. Section 07 27 26- Fluid- Applied Membrane Air Barrier

1.2 REFERENCES

A. The date of the standard is that in effect as the date of receipt of bids for the project.

B. ASTM International (ASTM):
1. D412-Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
2. D3273-Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
3. E84-Standard Test Method for Surface Burning Characteristics of Building Materials.
4. E154- Standard Test Method for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.

C. Brick Industry Association (BIA):
1. Technical Note on Brick Construction No. 7, Water Penetration Resistance- Design and Detailing.
2. Technical Note on Brick Construction No. 28B, Brick Veneer/Steel Stud Walls.

1.3 PERFORMANCE REQUIREMENTS

A. Performance requirements: Comply with the specified performance requirements and characteristics as herein specified.

B. Performance description:
1. The building envelope shall be constructed with a continuous, air and water-resistive barrier to control air leakage, avoid condensation in the interior wall assembly and prevent water intrusion.
2. Joints, penetrations and paths of water and air infiltration shall be made watertight and airtight.
3. System shall be capable of withstanding positive and negative combined wind, stack and HVAC pressures on the envelope without damage or displacement.
4. System shall be installed in an airtight and flexible manner, allowing for the relative movement of systems due to thermal and moisture variations.

1.4 SUBMITTALS

A. Product data:
1. Submit manufacturer’s product data and installation guidelines, including technical and test data.

B. Samples:
1. Submit one 3” by 5” flashing material sample.

C. Certificates:

1. Certificates by manufacturer stating that manufacturer and installer meet qualifications as herein specified.

1.5 QUALITY ASSURANCE

A. Applicable standards, as referenced herein: ASTM International (ASTM).
B. Manufacturer's qualifications: Provide flexible flashing by single manufacturer with no less than one (1) year experience in the production and sales of flexible flashing. Manufacturers proposed for use, but not named in these specifications, shall submit evidence of ability to meet all requirements specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.
B. Sequence deliveries to avoid delays and to minimize on-site storage.

1.7 WARRANTY

A. Manufacturer's warranty requirements:
   1. That the products will maintain their integrity for a period of five years after the substantial completion of the material application.
B. Warranty period: Five (5) years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Substitutions: [No Substitutions] [In accordance with Section 01 25 00 – Substitution Procedures].

2.2 MATERIALS

A. Flexible flashing that is comprised of a Type 304 sheet of stainless steel core with a polymer fabric laminated to one side of the stainless steel face with a non-asphalt adhesive:
   1. Product: PROSOCO R-Guard SS ThruWall Flashing, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
   2. Subject to compliance with the following physical and performance requirements:
      a. Puncture Resistance: Minimum 2,500 psi when tested in accordance to ASTM E154.
      b. Tensile strength: Minimum 100,000 psi when tested in accordance with ASTM D412.
      c. Surface burning characteristics: Class A Building Material, when tested in accordance with ASTM E84. Flame Spread: Less than or equal to 25, Smoke Developed: Less than or equal to 450.
      d. Mold Resistance: Pass testing requirements of ASTM D3273.
B. Flexible flashing that is comprised of a Type 316 sheet of stainless steel core with a polymer fabric laminated to one side of the stainless steel face with a non-asphalt adhesive that minimizes salt corrosion:
   1. Product: PROSOCO R-Guard SS ThruWall (Coastal) Flashing, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
   2. Subject to compliance with the following physical and performance requirements:
      a. Puncture Resistance: Minimum 2,500 psi when tested in accordance to ASTM E154.

b. Tensile strength: Minimum 100,000 psi when tested in accordance with ASTM D412.
c. Surface burning characteristics: Class A Building Material, when tested in accordance with ASTM E84. Flame Spread: Less than or equal to 25, Smoke Developed: Less than or equal to 450.
d. Mold Resistance: Pass testing requirements of ASTM D3273.]

2.3 ACCESSORIES

A. Solvent Free, Silyl-Terminated-Polymer (STP) sealant, designed for high dynamic and thermal movement at flexible flashing end joint splices and at flexible flashing connection to masonry wall.
1. Product: PROSOCO R-Guard FastFlash, manufactured by PROSOCO Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
2. Subject to compliance with the following physical and performance requirements:
a. Living Building Challenge 2.0/2.1/3.0/3.1 Red List.
b. AAMA 714-12 Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal Around Exterior Wall Openings in Buildings.
c. ICC-ES AC 212 Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing.
d. Comply with national, state and district AIM VOC regulations and be 30 g/L or less.
e. Water vapor transmission: 21 perms when tested in accordance with ASTM E96.
f. Tensile strength: Greater than 150 psi.
g. Elongation at break: Greater than 350 percent when tested in accordance with ASTM D412.
h. Total solids: 99 percent.
i. UV Resistance: No degradation of material when exposed less than 365 days of UV.
B. Outside corner and inside corner material; manufacturer’s standard available units using:
1. Stainless steel: 26 gauge stainless steel.
C. End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
1. Stainless steel: 26 gauge stainless steel.
D. Termination bar: Product standard of quality is York T-96 termination bar. Manufacturer's standard 1" composite termination bar with sealant lip.
E. Weep vent protection; manufacturer’s standard weep vent.

PART 3 EXECUTION

3.1 EXAMINATION AND SURFACE PREPARATION

A. Refer to manufacturer’s published recommendations for condition and preparation of substrates.
1. Surfaces shall be sound and free of spalled areas, loose aggregate, and sharp protrusions.

3.2 INSTALLATION

A. General: Comply with flexible flashing manufacturer’s published installation guidelines and literature.
B. Head and Sill Flashing:
1. Extend flashing 6" minimum beyond opening. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use pre-manufactured units made of 26 gauge stainless steel.
C. Standard Flashing width:

1. Width required starting flush with outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2".

D. Flashing Joints:
   1. Splice end joints by overlapping them 6” and seal with STP sealant.
E. Exterior sheathing cavity wall:
   1. Fasten to stud back-up at top by embedding in bead of STP sealant and use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with STP sealant.
   2. Lap with fluid applied air barrier membrane per Specification Section 07 27 26.
F. Masonry cavity wall:
   1. Apply after fluid applied air barrier installation specified in Specification Section 07 27 26 in accordance with manufacturer’s installation instructions.
   2. Fasten to masonry back-up surface at top by embedding in bead of STP sealant and use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with STP.
   3. Lap with fluid applied air barrier installation per Specification Section 07 27 26.
G. Concrete cavity wall:
   1. Apply after fluid applied air barrier installation specified in Specification Section 07 27 26 in accordance with manufacturer’s installation instructions.
   2. Fasten to concrete surface at top by embedding in bead of STP sealant.
   3. Lap with fluid applied air barrier per Specification Section 07 27 26.
H. Masonry Veneer and Foundation Sill Flashing Surfaces:
   1. Lay flashing in continuous bead of STP sealant on masonry supporting steel.
   2. Fold ends of flexible flashing at end of opening to form dam; seal with STP sealant or use purchased manufacturers preformed end dams.
   3. Inside and outside corners: Make in industry accepted manner using corner and splice material or purchase manufactured corners from manufacturer.
I. Parapet Flashing:
   1. Fasten flush to parapet surface by embedding flashing in bead of STP sealant.

3.3 PROTECTION

A. Protect flexible flashing from damage during remainder of construction period.
B. Repair damaged flashing per manufacturer’s published recommendations.

3.4 SCHEDULES

1. Exterior door heads.
2. Window heads and sills.
3. Storefront heads.
4. Horizontal control joints.
5. Changes in veneer materials, vertically.
6. Other wall openings.
7. Other locations indicated.

END OF SECTION

SECTION 077233

ROOF HATCHES

PART 1 GENERAL

1.1 SUMMARY

A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data.
B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
B. Installer: A minimum of 2 years experience installing similar products.
C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Type S Roof Hatch by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.BILCO.com.

2.2 ROOF HATCH

A. Furnish and install where indicated on plans metal roof hatch Type S, size width: 36" (914mm) x length: 30" (762mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.
B. Performance characteristics:
   1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m^2) with a maximum deflection of 1/150th of the span and a maximum design pressure of +/- 100 PSF (488 kg/m^2) with a design factor of 2 for galvanized steel (Type S-20) and aluminum (Type S-50) roof hatches or 20 psf (97 kg/m^2) for stainless steel (Type S-90) roof hatches or roof hatches with an aluminum cover and galvanized steel curb (Type S-40)].

2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
5. Galvanized steel (Type S-20) and aluminum (Type S-50) roof hatches shall have a valid Notice of Acceptance (NOA) by Miami-Dade County Product Control Section. The hatches shall have product approval (FL) by Florida Building Council regarding compliance to Florida Building Code.

C. Cover: Shall be 14 gauge (1.9mm) galvannealed steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be fiberglass of 1" (25mm) thickness, fully covered and protected by a metal liner [select: 22 gauge (.8mm) galvannealed steel or 18 gauge (1mm) aluminum].

E. Curb: Shall be 12" (305mm) in height and of 14 gauge (1.9mm) galvannealed steel. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

F. Curb insulation: Shall be rigid, high-density fiberboard of 1" (25mm) thickness on outside of curb.

G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe [for aluminum construction: welded to the curb assembly; for steel construction: through bolted to the curb assembly].

H. Hardware
1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
6. All hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, specify Type 316 stainless steel hardware].
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes: Factory finish shall be mill finish aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION

SECTION 077233

ROOF HATCH RAIL SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Work Included: Provide factory-fabricated fixed hatch railing system.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data.
B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
B. Installer: A minimum of 2 years experience installing similar products.
C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Type Bil-Guard® 2.0 Roof Hatch Railing System by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 800-366-6530, Fax: 1-203-535-1582, Web: www.bilco.com.

2.2 HATCH RAIL SYSTEM

A. Furnish and install where indicated on plans hatch rail system Model [insert RL2-S; RL2-NB; RL2-L; RL2-E; RL2-F, RL2-SS, RL2-D]. The hatch rail system shall be field assembled and installed (by others) per the manufacturer's instructions.
B. Performance characteristics:
   1. High visibility safety yellow powder coat paint finish (*other colors available as a special order*).
   2. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
   3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.29 and shall meet OSHA strength requirements with a factor of safety of two.
   4. Corrosion resistant construction with a five-year warranty.

5. Hinged gate shall ensure continuous barrier around the roof hatch.
6. Self-closing gate hinge and positive latching system provided with hatch rail system.

C. Posts and Rails: 1-1/4" (32mm) 6061 T6 schedule 40 aluminum pipe

D. Hardware: Mounting brackets shall be 3/8" (9mm) thick extruded aluminum. Pivoting post guides with compression fittings and latching mechanism shall be cast aluminum. Self-closing hinges and all fasteners shall be type 316 stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION

SECTIONS 079000

ROOF JOINT SEAL

WATERTIGHT ROOF EXPANSION JOINT SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. Expansion joints shall be a dual-seal, double-flanged, extruded thermoplastic rubber for sealing expansion joints in roofs through positive integration with the roofing membrane and a purpose-designed system for transitioning between the joint in the roof and joints in walls.

B. Related Work
   1. Division 3 - Cast-in-Place Concrete
   2. Division 7 - Thermal & Moisture Protection
   3. Division 7 - Sealants, Caulking and Waterproofing

1.2 SUBMITTALS

A. General – Submit the following according to Division 1 Specification Section.

B. Standard Submittal Package – Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.

C. Sample of material to be used in work is required at time of submittal.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's installation instructions.

1.4 BASIS OF DESIGN

A. All joints shall be designed to meet the specified performance criteria of the project as manufactured by: (USA & International) EMSEAL JOINT SYSTEMS, LTD 25 Bridle Lane, Westborough, MA 01581-2603, Toll Free: 800-526-8365.(Canada) EMSEAL, LLC 111 Royal Group Crescent, Woodbridge, Ontario, L4H 1X9, Canada Toll Free:]800-526-8365. www.emseal.com

B. Alternate manufacturers must demonstrate that their products meet or exceed the design criteria. Submittal of alternates must be made three weeks prior to bid opening to allow proper evaluation time.

1.5 QUALITY ASSURANCE

A. The General Contractor will conduct a pre-construction meeting with all parties and trades involved in the treatment of work at and around expansion joints including, but not limited to, concrete, mechanical, electrical, HVAC, landscaping, masonry, curtain wall, waterproofing, fire-stopping, caulking, flooring and other finish trade subcontractors. All superintendents and foremen with responsibility for oversight and setting of the joint gap must attend this meeting. The General Contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to expansion joints and that their work cannot impede anticipated structural movement at the expansion joints, or compromise the achievement of watertightness or life safety at expansion joints in any way.

B. Warranty – Manufacturer's standard warranty shall apply.

PART 2 PRODUCT

2.1 GENERAL

A. Provide watertight, expansion joint by EMSEAL Joint Systems for expansion joints in roof decks and isolation joints in non-traffic, high-movement and seismic structural joint in roof decks. Typical locations include, but are not limited to the following: applications for joints over occupied space, joints across roof lines, and solid slab construction anywhere waterproofed construction is specified. System shall perform waterproofing and movement-accommodation functions as the result of a single installation and without the addition of gutters, vapor barriers, bladders, or other devices suspended beneath or within the system in any way.

B. Provide Roof Joint as manufactured by EMSEAL JOINT SYSTEMS LTD and as indicated on drawings for horizontal expansion joint locations.

C. System shall be comprised of: 1.) a heat weldable, Nitrile PVC or TPV thermoplastic extrusion with dual-level flange and, 2.) manufacturer supplied termination bar and anchors and, 3.) factory welded downturn transition in the RoofJ oint gland that is sealed at a ship lapped 45-degree angle to mate with an interlocking factory-fabricated Roof Joint/SEISMIC COLORSEAL transition piece.

D. Final selection of the extrusion size to be coordinated between manufacturer, designer, and contractor(s) in consideration of expected movements as a product of structural design and expected temperature variations, taking into account as-built joint-gap sizes and temperatures at expected installation time. Width of joint-gaps at time of casting or cutting to be adjusted, if necessary, from baseline temperature used and specified by designer in determining system suitability.

E. Manufacturer’s Checklist must be completed by expansion joint subcontractor and returned to manufacturer at time of ordering material.

2.2 FABRICATION

A. Include details and manufacturing drawings indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joinery with other types, special end conditions, fasteners, and relationship to adjoining work and finishes with specific reference to tie-in with deck waterproofing system through integration with expansion joint system dual-level flange.

B. Directional changes and terminations into vertical plane surfaces (walls, parapets, ends of decks, etc) as well as to transition the material through curbs or other in-slab plane changes to be provided by factory-manufactured assemblies that preserve continuity of seal. Transitions between Roof Joint and any other of Manufacturer’s joint systems in the vertical plane to be executed according to Manufacturer’s details and to be warranted as watertight.

PART 3 EXECUTION

3.1 INSTALLATION

A. Preparation of the Work Area

1. The contractor shall provide properly formed and prepared expansion joint openings constructed to the exact dimensions and elevations shown on manufacturer’s standard system drawings or as shown on the contract drawings. Deviations from these dimensions will not be allowed without the written consent of the engineer of record.
2. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.
3. System to be installed by qualified sub-contractors only according to detailed published installation procedures and/or in accordance with job-specific installation instructions of manufacturer’s field technician. The applicator must be the same contractor that will be installing the deck waterproofing system. Bids must include for presence of paid-for manufacturer’s field technician to be present during initial preparation, inspection, and material installation.

3.2 CLEAN AND PROTECT

A. Protect the system and its components during construction. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

END OF SECTION

SECTION 079100

EXTERIOR WALL JOINT SEALS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preformed, precompressed, expanding foam joint seals for expansion joints in exterior walls.
B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.
   2. Section 079000 Roof Joint, 079500 Seismic Roof Expansion Control System

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Convene at Project site 2 weeks prior to beginning work of this Section.
   2. Attendance: Contractor, joint seal installer, and related trades
   3. Review and discuss:
      a. Joint seal manufacturer's requirements, project conditions, allowable structural movement at joints, and protection of completed work.
      b. Transitions in plane and direction, and requirement for continuity of seal through watertight transitions from wall expansion joint to other interfacing expansion joint systems at adjacent construction.

1.3 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Indicate joint locations, dimensions, and adjacent construction.
      b. Provide details for transitions in plane and direction for continuity of seal through watertight transitions from wall expansion joint to other interfacing expansion joint systems at adjacent construction.
   2. Product Data: Material description and application instructions.
   3. Samples:
      a. Minimum 1.5 x 1.5 inch joint seal samples showing available colors.
      b. Minimum 12 inch long samples.
B. Informational Submittals:
   1. Manufacturer's certification that:
      a. Products are capable of withstanding temperature of 150 degrees F (65 degrees C) for 3 hours while compressed to minimum of movement capability dimension without evidence of bleeding of impregnation medium from material.
      b. Same material after heat stability test and after cooling to room temperature will self-expand to maximum of movement capability dimension within 24 hours at 68 degrees F (20 degrees C).
C. Sustainable Design Submittals: Refer to Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Minimum 20 years experience in production of specified materials.
B. Installer Qualifications: Minimum 20 years experience in work of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. In accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products by Sika Emseal, 800-526-8365, www.emseal.com.
B. Substitutions: Product to be approved by architect and engineer

2.2 MATERIALS

A. Exterior Wall Joint Seal:
1. Source: Seismic Colorseal by Sika Emseal
2. Description: Silicone coated, ultraviolet resistant, watertight, primary wall seal with factory-applied adhesive on one side.
3. Form: Precompressed to less than nominal material size for installation into designed joint size equal to material nominal size.
4. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
5. R-value: 2.15 per inch depth at nominal joint size compression, tested to ASTM C518.
6. STC rating: 52 in STC 56 wall, tested to ASTM E90.
7. OITC rating: 38 in OITC 38 wall, tested to ASTM E90.
8. Air permeability: Maximum 0.02 liter per second per square meter, tested to ASTM E283 at 75 Pa.
9. Water penetration: No water penetration, tested to ASTM E331 at 5000 Pa test pressure.
10. Wind loading:
a. 0.1 mm net deflection, tested to ASTM E330 at 2730 Pa or 150 MPH wind.
b. 0.6 mm net deflection, tested to ASTM E330 at 4854 Pa or 200 MPH wind.
11. Weathering: Sealing of outside wall joints per DIN 18542-1999 / G155-2013: Pass
12. VOC Emissions: CDPH-1.2-2017: Pass
13. Color: Gray
14. Silicone: Field applied corner bead at face of seal to substrate interface, furnished by joint seal manufacturer, in same material and color as used in factory coating.
a. Abrasion Resistance: Less than 1% weight loss, tested to ASTM D4060
b. Fuel Resistance: Pass, tested to ASTM C719/C1135

2.3 ACCESSORIES

A. Joint Sealer:
1. Type: ASTM C920, Type NS, Class 50, Use NT, M, G, A, or O, one part, neutral curing.
2. Source: Sikasil WS-295 by Sika Corporation. www.usa.sika.com
3. Color: Gray

PART 3 EXECUTION

3.1 PREPARATION

A. Clean joints thoroughly; remove loose and foreign matter that could impair adhesion or performance.

3.2 INSTALLATION

A. Install joint seal in accordance with Sika Emseal instructions and approved Shop Drawings.
B. Remove joint seal from precompressed packaging, immediately insert into joint, and allow to expand.
C. Use temporary retainers if required to maintain joint seals in position until expansion is complete.
D. Install joint sealer in accordance with Sika instructions.

END OF SECTION

SECTION 079500

SEISMIC ROOF EXPANSION CONTROL SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work shall consist of furnishing and installing roof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. The joints are proprietary designs utilizing extruded elastomeric seals, base members and support plates.

B. Related Work
   1. Cast-in-place concrete
   2. Miscellaneous and ornamental metals
   3. Flashing and sheet metal
   4. Sealants and caulking

1.2 SUBMITTALS

A. Template Drawings - Submit typical seismic joint cross-section(s) indicating pertinent dimensioning, general construction, component connections, and anchorage methods.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products in each manufacturer's original, intact, labeled containers and store under cover in a dry location until installed. Store off the ground, protect from weather and construction activities.

1.4 ACCEPTABLE MANUFACTURER

A. All joints shall be as manufactured/supplied by Sika Emseal, 25 Bridle Lane, Westborough, MA 01581 USA.

B. Alternate manufacturers and their products will be considered, provided they meet the design concept and are produced of materials that are equal to or superior to those called for in the base product specification.

C. Any proposed alternate systems must be submitted and receive approval 21 days prior to the bid. All post bid submittals will not be considered. This submission shall be in accordance with MATERIALS AND SUBSTITUTION.

- Any manufacturer wishing to submit for prior approval must provide the following:
   1. A working 6” sample of the proposed system with a letter describing how system is considered superior to the specified system.
   2. A project proposal drawing that illustrates the recommended alternate system installed in the roof construction that is specific to the project. Typical catalog cut sections will not be considered.
   3. Verifiable list of prior installations showing prior and successful experience with the proposed systems.
   4. Any substitution products not adhering to all specification requirements within, will not be considered.

1.5 QUALITY ASSURANCE

A. Warranty: Standard material limited warranty or project specific warranty available. Installation shall be in strict accordance with manufacturer’s technical specifications, details, installation instructions and general procedures in effect for normal intended usage and suitable applications under specific design movements and loading conditions.

B. Manufacturer: Shall have a minimum ten (10) years experience specializing in the design and manufacture of Architectural Expansion Control Systems

C. Application: Minimum 2 years [documented] experience in work of this Section

PART 2 PRODUCT

2.1 2.01 GENERAL

A. Provide watertight roof joint cover expansion control system that is capable of accommodating multi-directional seismic movement without stress to its components. System shall consist of metal profiles that incorporates a universal aluminum base member designed to accommodate various project conditions and roof treatments. The cover plate shall be designed of width and thickness required to satisfy movement and loading requirements. Secure cover plate to base members by utilizing manufacturer's pre-engineered seismic-centering bar. Provide system that resists damage or deterioration from the impact of falling ice, exposure to UV, airborne contaminants and occasional foot traffic from maintenance personnel.

Furnish Wabo®RoofCover, Model "RFC" for exterior joint locations as manufactured by Sika Emseal and as indicated on drawings.

2.2 2.02 COMPONENTS AND MATERIALS

A. Aluminum Base Member - Provide extrusion profile with semi-closed circular cavity to lock and secure sphered ends of manufacturer's self-centering bar. Design profile with integral drip edges located at critical corners to prevent moisture penetration. Include additional cavity at top surface of profile to mechanically lock preformed cover plate gasket. Material is to conform to properties of ASTM B221, Alloy 6061-T6 or 6063-T-5.

B. Aluminum Shapes - Material to conform to ASTM B209, alloy 5005-H34.

C. Cover Plate - Material to be aluminum conforming to ASTM B209, alloy 5005-H34. Cover plate to be secured to joint assembly utilizing self-sealing, threaded hardware and pre-engineered self-centering bars that freely rotate in all directions. Preformed metal devices that utilize tension or compression to maintain and secure slide plate will not be allowed. Thickness shall be as recommended by manufacturer to satisfy project requirements. Cover plate material thickness shall typically be .080 inch. Follow manufacturer's recommendations to increase thickness where opening and project requirements otherwise dictate.

D. Seismic-Centering Bar - Shall exhibit circular sphered ends that lock and slide inside the corresponding aluminum extrusion cavity to allow freedom of movement and flexure in all directions including vertical displacement. Bar shall be molded or manufactured incorporating corrosion resistant nylon components with sphered ends and 1" wide standard cross member for standard applications. Provide 1 ½" wide cross member where severe wind and uplift is expected. Spacing shall be a maximum of 18" O.C. During seismic activity design centering bar to permit accelerated inward and outward movement without evidence of fatigue and permanent deformation. Concurrently provide secure connection between plate and underlying system components to maintain proper positioning and contact to adjoining surfaces. Bar shall exhibit the following physical properties to demonstrate ability to resist corrosion and fatigue.

Physical Properties:

1.	Molded End Profile:	
2.	Material:	Nylon
3.	Color:	Black
4.	Tensile Strength @ break:	ASTM D638 25,500 psi
5.	Cross-Member:	
6.	Material:	Pre-tempered spring steel

E. Damage Mitigation - Test Requirements:
Seismic-centering bar must exhibit ability to disengage (controlled release) from expansion joint edge member(s) when seismic movement exceeds the specified maximum allowable opening. Submit independent test report demonstrating required design of seismic-centering bar.

Requirements:

1.	Equipment:	- Instron Machine
2.	Orientation:	- Specimen subjected to tensile load with cross member parallel to direction of load
3.	Specimens:	- Test 4(min) – select at random
4.	Disengagement range (lbs):	- 800 (min.) – 1250 (max.)

F. Moisture Barrier:
Standard: - Shall be a fabric reinforced tear resistant clear vinyl sheet material. Minimum thickness shall be .026".

Optional: - Provide fabric reinforced neoprene sheet material. Minimum thickness shall be .060".
Neoprene sheet shall be in accordance with the following properties.

1.	Fabric Type:	4 ounce polyester cloth
2.	Temperature Range:	-30F to +200F
3.	Hardness Shore A	70 +/-5
4.	Tensile, PSI	1000
5.	Elongation, %	250
6.	Tear, Die C, PPI	150

G. Drain Tube (optional) - Provide 1 ½" I.D. x 1/8" wall, clear PVC flexible tubing. Length and location of building drain to be determined by Architect.

H. Cover Plate Gasket - Provide extruded profile designed to prevent moisture penetration where in contact with underside of cover plate. Material shall be E.P.D.M. exhibiting a shore "A" hardness of 65 +/-5 in accordance with manufacturer's requirements.

I. Anchorage - Provide minimum ¼" diameter anchor at maximum 18" O.C. spacing to secure aluminum base member to roof construction or preformed aluminum support angle. Upgrade anchorage to 12" O.C. spacing where severe wind and uplift is expected.

J. Accessories - Provide necessary and related parts, sealants and fasteners required for complete installation.

K. Fire Barrier Assembly - Designed to provide the required fire endurance rating, minimize passage of smoke and accommodate dynamic movement without stress or degradation to its components. Test system in maximum joint width incorporating a field splice in accordance with UL-2079. Supply Sika Emseal Emshield® DFR2 (1-2-hour) , or DFR3 (3-hour) for joints ½" to 4" wide or Wabo®FireFlex (up to 20" wide and 2-hour fire rating) Fire Barrier Blanket System as governed by joint opening, test requirements and fire rating.

2.3 FABRICATION

A. Extrusions and generic profiles to be shipped in standard 10 ft. lengths and shall be cut to length on jobsite where required. Profiles shall be miter cut in the field to conform to directional changes unless otherwise contracted with expansion joint manufacturer. Where extruded base member's flange is utilized to secure profile and joint assembly directly to the roof construction provide factory drilled anchor holes at 18" o.c. minimum spacing, unless otherwise specified.

B. Provide necessary hardware and factory preformed aluminum profiles to complete field splicing between standard lengths of cover plate.

C. Fire Barriers - Ship manufacturer's standard assembly including fire caulks, sealants (if applicable) and hardware for the required hourly rating. Assemblies shall be miter cut in the field to accommodate changes in direction.

2.4 FINISHES (STANDARD)

A. Aluminum extrusions shall be supplied in standard mill finish.

B. Aluminum shapes shall be supplied in standard mill finish.

C. Finishes (optional) - Cover plate only.

1. Aluminum (clear anodized)
   Clear anodized finish in accordance with AA-M10 C22 A41 Class I
   (0.7 - 1.0 thick anodic coating).

PART 3 EXECUTION

3.1 INSTALLATION

A. Protect all expansion joint component parts from damage during installation, placement of roof materials and thereafter until completion of structure.
B. Expansion joint systems shall be installed in strict accordance with the manufacturer's typical details and instructions along with the advice of their qualified representative.
C. Expansion joint systems shall be set to the proper width for the ambient temperature at the time of installation. This information is indicated in the contract plans.

3.2 CLEAN AND PROTECT

A. Protect system and its components during construction. After work is complete in adjacent areas clean exposed surfaces with a suitable cleaner that will not harm or attack the cover plates finish and the threaded hardware's rubber ring gasket.

END OF SECTION

SECTION 084113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section covers Kawneer Aluminum Entrances, including glass and glazing, door hardware, and components.
B. Types of Kawneer Aluminum Entrances include:
   1. 350 Swing Door:
      a. Medium stile
      b. Vertical face dimension: 3-1/2" (88.9 mm)
      c. Depth: 1-3/4" (44.5 mm)
      d. High-traffic applications
C. Related Sections:
   1. 072700: Air Barriers
   2. 079200: Joint Sealants
   3. 083213: Sliding Aluminum-Framed Glass Doors
   4. 084313: Aluminum-Framed Storefronts
   5. 086300: Metal-Framed Skylights
   6. 087000: Hardware
   7. 088000: Glazing
   8. 280000: Electronic Safety and Security

1.3 DEFINITIONS

A. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary (AAMA AG-13).

1.4 PERFORMANCE REQUIREMENTS

A. General Performance:
   1. Aluminum-framed entrance system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
B. Wind Loads:
   1. The entrance system shall include anchorage that is capable of withstanding the following wind load design pressures:
      a. Inward: 36.13 psf
      b. Outward: - 38.31 psf
   2. The design pressures are based on the IBC Building Code, 2015 Edition.
C. Air Leakage:
   1. For single-acting offset pivot or butt-hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 1.57 psf (75 Pa) for single doors and pairs of doors.
   2. A single 3'0" x 7'0" (915 mm x 2134 mm) entrance door and frame shall not exceed 1.0 cfm/ft^2.
   3. A pair of 6'0" x 7'0" (1830 mm x 2134 mm) entrance doors and frame shall not exceed 1.0 cfm/ft^2.
D. Structural-Test Performance:

1. Corner strength shall be tested per the Kawneer dual moment load test procedure and certified by an independent testing laboratory to ensure weld compliance and corner integrity. (Testing procedure and certified test results are available upon request.)

1.5 SUBMITTALS

A. Product Data:
   1. For each type of aluminum-framed entrance door indicated, include:
      a. Construction details
      b. Material descriptions
      c. Fabrication methods
      d. Dimensions of individual components and profiles
      e. Hardware
      f. Finishes
      g. Installation instructions
B. Shop Drawings:
   1. Plans
   2. Elevations
   3. Sections
   4. Details
   5. Hardware
   6. Attachments to other work
   7. Operational clearances
   8. Installation details
C. Samples for Initial Selection:
   1. Provide samples for units with factory-applied color finishes.
   2. Provide samples of hardware and accessories involving color selection.
D. Samples for Verification:
   1. Provide a verification sample for aluminum-framed entrance doors and required components.
E. Product Test Reports:
   1. Provide test reports for each type of aluminum-framed entrance door used in the project.
   2. Test reports must be based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency.
   3. Test reports must indicate compliance with performance requirements.
F. Fabrication Sample:
   1. Provide a fabrication sample of a corner, consisting of a door stile and rail and using full-size components that show details of the following:
      a. Joinery,
      b. Glazing

G. Entrance Door Hardware Schedule:
   1. Schedule shall be prepared by or under the supervision of supplier.
   2. Schedule shall detail fabrication and assembly of entrance door hardware, including procedures and diagrams.
   3. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer must have successfully installed the same or similar units required for the project and other projects of similar size and scope.
B. Manufacturer Qualifications:
   1. Manufacturer must be capable of fabricating aluminum-framed entrance doors and storefronts that meet or exceed the stated performance requirements.

2. Manufacturer must document this performance by the inclusion of test reports and calculations.

C. Source Limitations:
1. Obtain aluminum-framed entrance doors through one source from a single manufacturer.

D. Product Options:
1. Drawings indicate size, profiles, and dimensional requirements of aluminum-framed entrance doors and are based on the specific system indicated. Refer to Division 01 Product Requirements Section. Do not modify size and dimensional requirements.
2. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups:
1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
2. Build mockup for the type(s) of swing entrance door(s) indicated, in location(s) shown on drawings.

F. Pre-installation Conference:
1. Conduct conference at project site to comply with requirements in Division 01 Project Management and Coordination Section.

1.7 PROJECT CONDITIONS

A. Field Measurements:
1. Verify actual dimensions of aluminum-framed entrance door openings by field measurements before fabrication.
2. Indicate measurements on shop drawings.

1.8 WARRANTY

A. Submit manufacturer's standard warranty for owner's acceptance.

B. Warranty Period:
1. Two years from Date of Substantial Completion of the project provided however that in no event shall the Limited Warranty begin later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product:
1. Kawneer Company, Inc.
2. The door stile and rail face dimensions of the medium style entrance door will be as follows:
    1). Vertical face dimension: 3-1/2" (88.9 mm)
    2). Top Rail: 3-1/2" (88.9 mm)
    3). Bottom Rail: 10" (254.0 mm)
3. Major portions of the door members shall be 0.125" (3.2 mm) nominal thickness.
4. Glazing molding shall be 0.05" (1.3 mm) thick.
5. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
6. Provide adjustable glass jacks to help center the glass in the door opening.

B. Subject to compliance with requirements, provide a comparable product by the following:
1. Manufacturer: CRL
2. Series: Platinum Full Framed Doors
3. Profile Dimension: FFM1 Medium Stile Door

C. Substitutions:
1. Refer to Division 01 Substitutions Section for procedures and submission requirements.
2. Pre-Contract (Bidding Period) Substitutions:
    a. Submit written requests ten (10) days prior to bid date.
3. Post-Contract (Construction Period) Substitutions:

a. Submit written request in order to avoid installation and construction delays.

4. Product Literature and Drawings:
   a. Submit product literature and drawings modified to suit specific project requirements and job conditions.
5. Certificates:
   a. Submit certificate(s) certifying that the substitute manufacturer (1) attests to adherence to specification requirements for aluminum-framed entrance door system performance criteria, and (2) has been engaged in the design, manufacture, and fabrication of aluminum-framed entrance doors for a period of not less than ten (10) years.
6. Test Reports:
   a. Submit test reports verifying compliance with each test requirement required by the project.
7. Samples:
   a. Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance:
1. Acceptance will be in written form, either as an addendum or modification.
2. Acceptance will be documented by a formal change order signed by the owner and contractor.

2.2 MATERIALS

A. Aluminum Extrusions:
1. Alloy and temper recommended by aluminum-framed entrance door manufacturer for strength, corrosion resistance, and application of required finish.
2. Not less than 0.090" (2.3 mm) wall thickness at any location for the main frame and door leaf members.
3. Recycled Content:
   a. Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
   b. Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
   c. Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
   d. Indicate the location for recovery of recycled content.
   e. Indicate the location of the manufacturing facility.

B. Fasteners:
1. Aluminum, nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories:
1. Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
2. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

D. Reinforcing Members:
1. Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
2. Reinforcing members must provide sufficient strength to withstand the design pressure indicated.

E. Weather Seals:
1. Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material.
2. Comply with AAMA 701/702.

2.3 STOREFRONT ENTRANCE FRAMING SYSTEM

A. Storefront Entrance Framing:
1. Thermally Broken Entrance Framing:

a. Kawneer IsoLock® Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
b. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Non-Brackets and Reinforcements:
1. Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.

C. Fasteners and Accessories:
1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials.
2. Where exposed, fasteners and accessories shall be stainless steel.

D. Perimeter Anchors:
1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

E. Packing, Shipping, Handling, and Unloading:
1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection:
1. Store materials so that they are protected from exposure to harmful weather conditions.
2. Handle material and components to avoid damage.
3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

2.4 GLAZING

A. Glazing shall comply with requirements in Division 08 Glazing Section.
B. Glazing Gaskets:
1. Manufacturer's standard compression types
2. Replaceable, extruded EPDM rubber

C. Spacers and Setting Blocks:
1. Manufacturer's standard elastomeric type

2.5 HARDWARE

A. General Hardware Requirements:
1. Provide manufacturer's standard hardware.
2. Hardware shall be fabricated from aluminum, stainless steel, or other corrosion-resistant material that is compatible with aluminum.
3. Hardware shall be designed to smoothly operate, tightly close, and securely lock aluminum-framed entrance doors.

B. Standard Hardware:
1. Weather-Stripping:
a. Meeting stiles on pairs of doors shall be equipped with an adjustable astragal using wool pile with polymeric fin.
b. The door weathering on a single-acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
2. Sill Sweep Strips:
a. EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners (necessary to meet specified performance tests)
3. Threshold:
a. Extruded aluminum
b. One piece per door opening

c. Ribbed surface
4. Butt Hinge:
a. Kawneer® standard is stainless steel with powder coating and non-removable pin (NRP).
b. The EL Offset Pivot is available for access control.
5. Exterior Push/Pull: vertical rod style
6. Exit Device: Van Duprin 99XP Rim Exit Device
7. Door Closer / Operator: LCN 4640
8. Cylinder(s) / Thumbturn: Corbin Rosswin
9. Electric Strike / Strike Keeper: HES 9600 Series

2.6 FABRICATION

A. Fabricate aluminum-framed entrance doors in sizes indicated.
B. Include a complete system for assembling components and anchoring doors.
C. Fabrication requirements:
1. Aluminum-framed glass doors shall be re-glazable without dismantling perimeter framing.
2. Door corner construction:
a. Mechanical clip fastening
b. SIGMA deep-penetration plug welds
c. 1-1/8" (28.6 mm) long fillet welds inside and outside of all four corners
d. Hook-in type glazing stops with EPDM glazing gaskets reinforced with non-stretchable cord
3. Joint construction:
a. Accurately fit and secure joints and corners.
b. Make joints hairline in appearance.
4. Prepare components with internal reinforcement for door hardware.
5. Arrange fasteners and attachments to conceal from view.
D. Weather-stripping:
1. Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details.

2.7 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
B. Factory Finishing:
1. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color TBD)

PART 3 EXECUTION

3.1 EXAMINATION

A. With installer present, examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work:
1. Verify rough opening dimensions.
2. Verify levelness of sill plate.
3. Verify operational clearances.
4. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components for proper water management.
5. Masonry Surfaces:
a. Masonry surfaces must be visibly dry and free of excess mortar, sand, and other construction debris.
6. Wood Frame Walls:
a. Wood frame walls must be dry, clean, sound, well nailed, free of voids, and without offsets at joints.

b. Ensure that nail heads are driven flush with surfaces in opening and within 3" (76.2 mm) of opening.

7. Metal Surfaces:
   a. Metal surfaces must be dry and clean (free of grease, oil, dirt, rust, corrosion, and welding slag).
   b. Ensure that metal surfaces are without sharp edges or offsets at joints.

B. Proceed with installation only after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with drawings, shop drawings, and manufacturer's written instructions for installing aluminum-framed entrance doors, hardware, accessories, and other components.
B. Install aluminum-framed entrance doors so that the doors:
   1. Are level, plumb, square, and true to line
   2. Are without distortion and do not impede thermal movement
   3. Are anchored securely in place to structural support
   4. Are in proper relation to wall flashing and other adjacent construction
C. Set the sill threshold in a bed of sealant, as indicated, for weathertight construction.
D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Upon owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjusting: Not applicable.
B. Protection:
   1. Protect installed product’s finish surfaces from damage during construction.
C. Cleaning:
   1. Avoid damaging protective coatings and finishes.
   2. Clean glass and aluminum surfaces of product immediately after installation.
   3. Comply with glass manufacturer's written recommendations for final cleaning and maintenance.
   4. Remove non-permanent labels and clean surfaces.
   5. Remove excess sealants, glazing materials, dirt, and other substances.
   6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
   7. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 084113

SECTION 092900

GYPSUM DRY WALL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the gypsum drywall as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Gypsum board work for partitions, ceilings, column enclosures, furring, and elsewhere where gypsum drywall work is shown on drawings.
2. Metal supports for gypsum drywall construction.
3. Acoustical insulation for gypsum drywall work.
4. Sealant for gypsum drywall work.
5. Concealed metal reinforcing for attachment of railings, toilet partitions and other items supported on drywall partitions and walls.
6. Taping and finishing of drywall joints.
7. Installing rings and frames in drywall surfaces for grilles, registers and lighting fixtures.
8. Bracing and connections.

1.3 RELATED SECTIONS

A. Hollow metal door frames - Section 081113.
B. Access doors - Section 083113.
C. Painting - Section 099000.
D. Rings for grilles, registers and light fixtures - Division 23 and 26.

1.4 QUALITY ASSURANCE

A. The following standards, as well as other standards which may be referred to in this Section, shall apply to the work of this Section:

1. THE GYPSUM CONSTRUCTION HANDBOOK, LATEST EDITION, USG.
2. Construction Guide, latest edition, National Gypsum.
3. ASTM A 568 "Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements For"
4. ASTM C 475 "Standard Specification for Joint Treatment Materials for Gypsum Wallboard Construction"
5. ASTM C 645 "Standard Specification for Non-Structural Steel Framing Members"
6. ASTM C 754 "Standard Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products"
7. ASTM C 840 "Standard Specification for Application and Finishing of Gypsum Board"
8. ASTM C 919 "Standard Specification for Use of Sealants in Acoustical Applications"
9. ASTM C 954 "Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 in. to 0.112 in. in Thickness"
10. ASTM C 1002 "Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Board"
11. ASTM C 1177 "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing"
12. ASTM C 1178 "Standard Specification for Glass Mat Water Resistant Gypsum Backing Board"
13. ASTM C 1278 "Standard Specification for Fiber-Reinforced Gypsum Panel"
14. ASTM C 1396 "Standard Specification for Gypsum Board"
15. ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber"

B. Allowable Tolerances: 1/32" offsets between planes of board faces, and 1/16" in 8'-0" for plumb, level, warp and bow.
C. System Design Load
   1. Provide standard drywall wall assemblies designed and tested by manufacturer to withstand a lateral load of 5 lbs. per sq. ft. for the maximum wall height required, and with deflection limited to L/240 of partition height.
      a. Drywall assemblies with tile finish shall have a deflection limit of L/360.
   2. Provide drywall ceiling assemblies designed, fabricated and installed to have a deflection not to exceed L/360.
D. Fire-Resistance Rating: Where gypsum drywall with fire resistance ratings are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories, or to design designations in UL "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction, and compliant with UL Test #2079; criteria for cycle movement for all field height wall sections requiring allowance for vertical deflection within framing details.
E. Installer: Firm with not less than 5 years of successful experience in the installation of specified materials.
F. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

1.5 SUBMITTALS

A. Submit shop drawing for each drywall partition, furring and ceiling system showing size and gauges of framing members, hanger and anchorage devices, wallboard types, insulation, sealant, methods of assembly and fastening, control joints indicating column lines, corner details, joint finishing and relationship of drywall work to adjacent work.
B. Samples: Each material specified herein, 12" x 12", or 12" long, or in manufacturer's container, as applicable for type of material submitted.
C. Manufacturer's Literature: Submit technical and installation instructions for each drywall partition, furring and ceiling system specified herein, and for each fire-rated and sound-rated gypsum board assembly. Submit other data as required to show compliance with these specifications, including data for mold resistant joint compound.
D. Test Reports: This Contractor shall submit test report, obtained by drywall manufacturer, indicating conformance of drywall assemblies to required fire ratings and sound ratings.
E. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

1.6 PRODUCT HANDLING AND PROTECTION

A. Deliver, store and handle drywall work materials to prevent damage. Deliver materials in their original, unopened containers or bundles, and store where protected from moisture, damage and from exposure to the elements. Store wallboard in flat stacks.
B. Protect wallboard from becoming wet.
C. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

1.7 ENVIRONMENTAL CONDITIONS

A. Provide and maintain minimum temperature of fifty-five (55) degrees F. and adequate ventilation to eliminate excessive moisture within the building in the area of the drywall work for at least twenty-four (24) hours, prior to, during and after installation of drywall work. Installation shall not start until windows are glazed and doors are installed, unless openings are temporarily closed. Space above suspended ceilings shall be vented sufficiently to prevent temperature and pressure build up.

1.8 JOB MOCK-UP

A. At a suitable location, where directed by the Architect, lay up a portion of a finished wall and ceiling demonstrating the quality of work, including finishing, to be obtained under this Section. Omit drywall boards in locations as directed by the Architect to show stud spacing and attachments, after acceptance, complete assembly.
B. Adjust the finishing techniques as required to achieve the finish required by the Architect as described in this Section of these specifications.
C. Upon approval of the mock-up, the mock-up may be left in place as a portion of the finished work of this Section.

D. All drywall work shall be equal in quality to approved mock-up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Gypsum Drywall Panels and Accessories: U.S. Gypsum Co., Georgia Pacific, CertainTeed Corporation, Certainteed, or National Gypsum Co. meeting specification requirements are acceptable.
   1. All drywall products must be manufactured in North America.
B. Acceptable Manufacturers for Metal Supports of Drywall Assemblies: Unless otherwise noted, provide products manufactured by ClarkDietrich, Super Stud Building Products, Marino/Ware, or approved equal.

2.2 METAL SUPPORTS

A. Metal Floor and Ceiling Runners
   1. Provide vinyl barrier track liner equal to ProTRAK liner or approved equal.
   2. Drywall Track: Formed from 0.0312 inch (20 U.S. Std. gauge) (minimum unlessotherwise noted or required by performance requirements) cold formed steel, width to suit shaped metal studs. Use 20 ga. top runners with 1-1/4" minimum flanges.
   3. Deflection track or head of wall connections at rated partitions shall conform to UL #2079 for cycle movement. Provide positive mechanical connection of framing to structure, allowing for vertical movement within connections. Minimum of 0.0312 (20 ga.) cold formed steel for clips, 25 ga. cold formed steel for deflection track.
      a. Products:
         1). ClarkDietrich; BlazeFrame DSL or MaxTrak
         2). Slotted Deflection Track As manufactured by the Steel Network
         3). VertiClip or VertiTrack or equal made by Metal-Lite Inc.
         4). FireTrak (including stud clips) by FireTrak Corp.
         5). Or approved equal.
B. Metal Studs, Framing and Furring
   1. C-Shaped Studs: Channel type with holes for passage of conduit formed from minimum 0.0312 inch (20 U.S. Std. gauge) (unless heavier gauge is required tomeet deflection limits) cold formed steel, width as shown on drawings.
   2. Furring Channels: Hat shaped, formed from galvanized steel, 25 U.S. Std. gauge.
      a. Product: ClarkDietrich; Furring Channel, or comparable product.
   3. Continuous 16 gauge x 8" wide steel wall plate screwed to studs as required for support of railings, toilet partitions and other items supported on drywall partitions and walls.
C. Suspended Ceiling and Fascia Supports
   1. Main Runners: 1-1/2" steel channels, cold rolled at 0.475 lbs. per ft., rust-inhibitive paint finish.
   2. Furring Members: Screw-type hat-shaped furring channels of 25 ga. zinc-coated steel; comply with ASTM C 645.
   3. Hangers: Galvanized, 1" x 3/16" flat steel slats capable of supporting 5x calculated load supported.
   4. Hanger Anchorages: Provide inserts, clips, bolts, screws and other devices applicable to the required method of structural anchorage for ceiling hangers. Size devices for 5x calculated load supported.
   5. Furring Anchorages: 16 ga. galvanized wire ties, manufacturer's standard clips, bolts or screws as recommended by furring manufacturer.
D. Protective Coating: All cold-formed steel members shall have coating conforming to AISI S220; ASTM A 653, G60 or coating with equivalent corrosion resistance ofASTM A653/A653M, G60. Galvannealed products are no acceptable.

2.3 GYPSUM WALLBOARD TYPES

A. Gypsum Wallboard: 1/2" thick and 5/8" thick as indicated on drawings, "Sheetrock" by USG, "Gold Bond" by National Gypsum, or "Regular Gypsum" by CertainTeed Corp.,48" wide, in maximum lengths available to minimize end-to-end butt joints.
B. Fire-Rated Gypsum Wallboard: 1/2" thick and 5/8" thick as indicated on drawings, "1/2" Sheetrock Firecode C" or 5/8" Sheetrock Ecosmart Firecode X by USG, "Gold Bond Fireshield" by National Gypsum, or "Type C" and "Type X" by CertainTeed Corp., 48" wide, in maximum lengths available to minimize end-to-end butt joints.

C. Water-Resistant Backing Board for Tile Finish: 5/8" thick, "DUROCK Glass Mat Tile Backerboard" by USG, "Dens-Shield Tile Backer Board" by Georgia Pacific, or"GlasRoc Tile Backer" by CertainTeed Corp. Cover joints with a pressure sensitive woven glass fiber tape equal to Imperial Type P Tape.

D. Moisture/Mold-Resistant Gypsum Wallboard at locations listed below, unless otherwise shown on drawings: 1/2" thick and 5/8" thick as indicated on drawings, "Mold Tough" or "Mold Tough Firecode X" by U.S. Gypsum, "DensArmor Plus" by Georgia Pacific, "Mold Defense" and/or "GlasRoc Interior"or “GlasRoc Type X” by Certainteed, or "Gold Bond EXP Interior Extreme Gypsum Board" by National Gypsum, 48" wide, in maximum lengths available to minimize end-to-end butt joints. Board must have a rating of 10 per ASTM D 3273 with a core that meets ASTM C1396, Section 6 or ASTM C 1658.

1. Areas in toilet rooms, lockers, janitor's closets not scheduled to receive ceramic tile, or where fire rating is required.
2. Walls and ceilings of spaces containing condensers, water tanks, water pumps and pressure reduction valves.
3. Portions of walls within 2 feet of kitchen sinks to a height of 4 feet above the floor.
4. Portions of walls within 2 feet of kitchen stoves to a height of 4 feet above the floor.
5. Walls of bathrooms that are not solely water closet compartments, other than walls specifically required to be cement board.
6. Walls and ceilings in service sink closets.
7. Portion of walls within 2 feet of mop sinks or service sinks to a height of 4 feet above the floor.
8. All perimeter walls and wet shafts.

2.4 ACCESSORIES

A. Acoustical Insulation: Paper-less, non-combustible, semi-rigid mineral fiber mat, 2" thick, in walls (unless otherwise indicated), 3 lb./cu. ft. maximum density; Thermafiber, Inc. (an Owens Corning company) "Thermafiber SAFB" or approved equal.

B. Fasteners for Wallboard: USG Brand Screws; Type S Bugle Head for fastening wallboard to lighter gauge interior metal framing (up to 20 ga.). Type S-12 Bugle Head for fastening wallboard to heavier gauge interior metal framing (20 ga. to 12 ga.); Type S and Type S-12 Pan Head for attaching metal studs to door frames and runners; and Type G Bugle Head for fastening wallboard to wallboard. Lengths specified below under "Part 3 - Execution" Articles and as recommended by drywall manufacturer.

1. For Portland cement base boards, fasteners shall be equal to Durock Steel Screws by U.S. Gypsum.

C. Laminating Adhesive: "Sheetrock Brand Joint Compound."

D. Metal Trim - Corner Beads: For 90 degree External Corners - ClarkDietrich; 103 Deluxe Cornerbead or "Dur-A-Bead" No. 103, 30 U.S. Std. ga. galvanized steel, 1-1/4" x 1-1/4", for 90 degree external corners.

E. Metal Trim - Edge Beads: "Sheetrock Brand Paper Faced Metal Bead and Trim."

F. Partition/Concrete Ceiling Trim: Trim-Tex Super Seal Tear Away or approved equal.

G. Metal Trim Treatment Materials and Joint Treatment Materials for Gypsum Drywall Boards: Paper tape for joint reinforcing; Setting Type (Durabond 90) or Lightweight Setting Type Joint Compound for taping and topping; and Ready Mix Compound for finishing.

1. For mold-resistant drywall, water resistant drywall, and tile backer board, use glass mesh tape with setting joint compound that is rated 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Acceptable joint compound is "Rapid Set One Pass" made by CTS Cement Manufacturing Corp. or approved equal meeting standards noted herein.

H. Control Joints: ClarkDietrich; #093 Control Joint or No. 0.093, USG.

I. Acoustical Sealant: USG "Acoustical Sealant" or "Tremco Acoustical Caulking" of Tremco Mfg. Co., Masterseal NP520 by BASF or approved equal.

J. Neoprene Gaskets: Conform to ASTM D 1056.

K. Reveal Base: Provide Fry Reglet Base of size noted on drawings DRMB (flat walls) and DRMBFL (curved walls), as manufactured by Fry Reglet Corporation, shall be installed. Aluminum shall be extruded alloy 6063 T5, with chemical conversion coating, clear anodized or other specified finish. Refer to finish schedule.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where gypsum drywall is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. General
1. Install drywall work in accordance with drywall manufacturer's printed instructions and as indicated on drawings and specified herein.
2. All metal framing for drywall partitions shall extend from floor to underside of structural deck above. Provide for vertical deflection with positive mechanical connections of framing members to structure.
3. Provide concealed reinforcement, 16 ga. thick by eight (8) inches wide or as detailed or as recommended by manufacturer, for attachment of railings, toilet partitions, and other items to be supported on the partitions which cannot be attached to the metal framing members. Concealed reinforcement shall span between metal studs and be attached thereto using two (2) self-tapping pan head screws at each stud.
a. Back of drywall shall be scored or notched to prevent bulging out where reinforcement plate occurs.

B. Fire-Rated Assemblies: Install fire-rated assemblies in accordance with requirements of authorities having jurisdiction, Underwriters' Laboratories and test results obtained and published by the drywall manufacturer, for the fire-rated drywall assembly types indicated on the drawings.

C. Acoustical Assemblies: Install acoustically-rated assemblies to achieve a minimum STC as noted on drawings, in accordance with test results obtained and published by the drywall manufacturer, for the drywall assembly type indicated on the drawings.

D. Sealant
1. Install continuous acoustical sealant bead at top and bottom edges of wallboard where indicated or required for sound rating as wallboard is installed, and between metal trim edge beads and abutting construction.
2. Install acoustical sealant in 1/8" wide vertical control joints within the length of the wall or partitions, and in all other joints, specified below under "Control Joints." Install bead of acoustical sealant around electric switch and outlet boxes, piping, ducts, and around any other penetration in the wallboard; place sealant bead between penetrations and edge of wallboard.
3. Where sealant is exposed to view, protect adjacent surfaces from damage and from sealant material, and tool sealant flush with and in same plane as wallboard surface. Sealant beads shall be 1/4" to 3/8" diameter.

E. Wallboard Application
1. Do not install wallboard panels until steel door frames are in place; coordinate work with Section 081113, "Steel Doors and Frames."
2. See drawings for all board types. Use fire-rated wallboard for fire-rated assemblies. Use water-resistant wallboard where indicated on drawings and where wallboard would be subject to moisture. Install water-resistant wallboard in full, large sheets (no scraps) to limit number of butt joints.
3. Apply wallboard with long dimension parallel to stud framing members, and with abutting edges occurring over stud flanges.
4. Install wallboard for partitions from floor to underside of structure above and secure rigidly in place by screw attachment, unless otherwise indicated.
5. Provide "Thermafiber" safing insulation meeting standards of Section 078413 at flutes of metal deck where partitions carry up to bottom of metal deck.
6. Neatly cut wallboard to fit around outlets, switch boxes, framed openings, piping, ducts, and other items which penetrate wallboard; fill gaps with acoustic sealant.
7. Where wallboard is to be applied to curved surfaces, dampen wallboard on back side as required to obtain required curve. Finish surface shall present smooth, even curve without fluting or other imperfections.
8. Screw fasten wallboard with power-driven electric screw driver, screw heads to slightly depress surface of wallboard without cutting paper, screws not closer than 3/8" from ends and edges of wallboard.
9. Where studs are doubled-up, screw fasten wallboard to both studs in a staggered pattern.

F. Metal Trim: Install and mechanically secure in accordance with manufacturer's instructions; and finish with three (3) coats of joint compound, feathered and finish sanded smooth with adjacent wallboard surface, in accordance with manufacturer's instructions.
1. Corner Beads: Install specified corner beads in single lengths at all external corners, unless corner lengths exceed standard stock lengths.
2. Edge Beads: Install specified edge beads in single lengths at all terminating edges of wallboard exposed to view, where edges abut dissimilar materials, where edges would be exposed to view, and elsewhere where shown on drawings. Where indicated on drawings, seal joint between metal edge bead and adjoining surface with specified gasket, 1/8" wide minimum and set back 1/8" from face of wallboard, unless other size and profile indicated on drawings.

3. Casing beads shall be set in long lengths, neatly butted at joints. Provide casing beads at juncture of board and vertical surfaces and at exposed perimeters.

G. Control Joint Locations: Gypsum board surfaces shall be isolated with control joints where:
1. Ceiling abuts a structural element, dissimilar wall or other vertical penetration.
2. Construction changes within the plane of the partition or ceiling.
3. Shown on approved shop drawings.
4. Ceiling dimensions exceed thirty (30) feet in either direction.
5. Wings of "L," "U," and "T" shaped ceiling areas are joined.
6. Expansion or control joints occur in the structural elements of the building.
7. Shaftwall runs exceed 30' without interruption.
8. Partition or furring abuts a structural element or dissimilar wall or ceiling.
9. Partition or furring runs exceed 30' without interruption.
10. Where control joints are required, ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners.

H. Joint Treatment and Spackling
1. Joints between face wallboards in the same plane, joints at internal corners of intersecting partitions and joints at internal corners of intersections between ceilings and walls or partitions shall be filled with joint compound.
2. Screw heads and other depressions shall be filled with joint compound. Joint compound shall be applied in three (3) coats, feathered and finish surface sanded smooth with adjacent wallboard surface, in accordance with manufacturer's instructions. Treatment of joints and screw heads with joint compound is also required where wallboard will be covered by finish materials which require a smooth surface, such as vinyl wall coverings.

3.3 FURRED WALLS AND PARTITIONS

A. Use specified metal furring channels. Run metal furring channel framing members vertically, space sixteen (16) inches o.c. maximum. Fasten furring channels to concrete or masonry surfaces with power-driven fasteners or concrete stub nails spaced sixteen (16) inches o.c. maximum through alternate wing flanges (staggered) of furring channel. Furring channels shall be shimmed as necessary to provide a plumb and level backing for wallboard. At inside of exterior walls, an asphalt felt protection strip shall be installed between each furring channel and the wall. Furring channel and splices shall be provided by nesting channels at least eight (8) inches and securely anchoring to concrete or masonry with two (2) fasteners in each wing.

B. Wallboard Installation: Same as specified under Article 3.4 - "Metal Stud Partitions."

3.4 METAL STUD PARTITIONS

A. Unless otherwise noted, steel framing members shall be installed in accordance with ASTM C 754.

B. Runner Installation: Use channel type. Align accurately at floor according to partition layout. Anchor runners securely sixteen (16) inches o.c. maximum with power-driven anchors to floor slab, with power-driven anchors to structural slab above. See "Stud Installation" below for runners over heads of metal door frames. Where required, carefully remove sprayed-on fireproofing to allow partition to be properly installed.

C. Stud Installation
1. Use channel type, positioned vertically in runners, spaced as noted on drawings, but not more than sixteen (16) inches o.c.
2. Anchor studs to floor runners with screw fasteners. Provide snap-in or slotted hole slip joint bolt connections of studs to ceiling runners leaving space for movement. Anchor studs at partition intersections, partition corners and where partition abuts other construction to floor and ceiling runners with sheet metal screws through each stud flange and runner flange.
3. Connection at ceiling runner for non-rated partitions shall be snap-in or slotted hole slip joint bolt connection that shall allow for movement. Seal studs abutting other construction with 1/8" thick neoprene gasket continuously between stud and abutting construction.
4. Connections for fire rated partitions at ceiling runners shall conform to UL Design #2079.
5. Install metal stud horizontal bracing wherever vertical studs are cut or wallboard is cut for passage of pipes, ducts or other penetrations, and anchor horizontal bracing to vertical studs with sheet metal screws.
6. At jambs of door frames and borrowed light frames, install doubled-up studs (not back to back) from floor to underside of structural deck, and securely anchor studs to jamb anchors of frames and to runners with screws. Provide cross braces from hollow metal frames to underside of slab.
7. Over heads of door frames, install cut-to-length section of runner with flanges slit and web bent to allow flanges to overlap adjacent vertical studs, and securely anchor runner to adjacent vertical studs with sheet metal screws.

Install cut-tolength vertical studs from runner (over heads of door frame) to ceiling runner sixteen (16) inches maximum o.c. and at vertical joints of wallboard, and securely anchor studs to runners with sheet metal screws.

8. At control joints, in field of partition, install double-up studs (back to back) from floor to ceiling runner, with 1/4" thick continuous compressible gasket between studs. When necessary, splice studs with eight (8) inches minimum nested laps and attach flanges together with two (2) sheet metal screws in each flange. All screws shall be self-tapping sheet metal screws.

D. Runners and Studs at Chase Wall: As specified above for "Runners" and "Studs" and as specified herein. Chase walls shall have either a single or double row of floor and ceiling runners with metal studs sixteen (16) inches o.c. maximum and positioned vertically in the runners so that the studs are opposite each other in pairs with the flanges pointing in the same direction. Anchor all studs to runner flanges with sheet metal screws through each stud flange and runner flange following requirements of paragraph 3.4, B. Provide cross bracing between the rows of studs by attaching runner channels or studs set full width of chase attached to vertical studs with one self-tapping screw at each end. Space cross bracing not over thirty-six (36) inches o.c. vertically.

E. Wallboard Installation - Single Layer Application (Screw Attached)

1. Install wallboard with long dimension parallel to framing member and with abutting edge joints over web of framing member. Install wallboard with long dimension perpendicular to framing members above and below openings in drywall extending to second stud at each side of opening. Joints on opposite sides of wall shall be arranged so as to occur on different studs.
2. Boards shall be fastened securely to metal studs with screws as specified. Where a free end occurs between studs, back blocking shall be required. Center abutting ends over studs. Correct work as necessary so that faces of boards are flush, smooth, true.
3. Wallboard screws shall be applied with an electric screw gun. Screws shall be driven not less than 3/8" from ends or edges of board to provide uniform dimple not over 1/32" deep. Screws shall be spaced twelve (12) inches o.c. in the field of the board and 8" o.c. staggered along the abutting edges.
4. All ends and edges of wallboard shall occur over screwing members (studs or furring channels). Boards shall be brought into contact but shall not be forced into place. Where ends or edges abut, they shall be staggered. Joints on opposite sides of a partition shall be so arranged as to occur on different studs.
5. At locations where piping receptacles, conduit, switches, etc., penetrate drywall partitions, provide non-drying sealant and an approved sealant stop at cut board locations inside partition.

F. Wallboard Installation - Double-Layer Application

1. General: See drawings for wallboard partition types required.
2. First Layer (Screw Attached): Install as described above for single layer application.
3. Second Layer (Screw Attached): Screw attach second layer, unless laminating method of attachment indicated on drawings or necessary to obtain required sound rating or fire rating. Install wallboard vertically with vertical joints offset thirty two (32) inches from first layer joints and staggered on opposite sides of wall. Attach wallboard with 1-5/8" screws sixteen (16) inches o.c. along vertical joints and sixteen (16) inches o.c. in the field of the wallboard. Screw through first layer into metal framing members.
4. Second Layer (Laminated): Install wallboard vertically. Stagger joints of second layer from first layer joints. Laminate second layer with specified laminating adhesive in beads or strips running continuously from floor to ceiling in accordance with manufacturer's instructions. After laminating, screw wallboard to framing members with 1-5/8" screws, spaced twelve (12) inches o.c. around perimeter of wallboard.

G. Wallboard Installation - Laminated Application: Where laminated wallboard is indicated, use specified laminating adhesive, install wallboard vertically and maintain tolerances as specified for screw attached wallboard.

H. Insulation Installation: Install where indicated on drawings. Place blanket tight between studs.

I. Deflection of Structure Above: To allow for possible deflection of structure above partitions, provide top runners for non-rated partitions with 1-1/4" minimum flanges and do not screw studs or drywall to top runner. Where positive anchorage of studs to top runner is required, anchorage device shall be by means of slotted hole (in clip connection with screw attachment to web of steel through bushings located in slots of clips), or other anchorage device approved by Architect.

J. Control Joints

1. Leave a 1/2" continuous opening between gypsum boards for insertion of surface mounted joint.
2. Back by double framing members.
3. Attach control joint to face layer with 9/16" galvanized staples six (6) inches o.c. at both flanges along entire length of joint.
4. Provide two (2) inch wide gypsum panel strip or other adequate seal behind control joint in fire rated partitions and partitions with safing insulation.

3.5 DRYWALL FASCIAS AND CEILINGS

A. Furnish and install inserts, hanger clips and similar devices in coordination with other work.
B. Secure hangers to inserts and clips. Clamp or bolt hangers to main runners.
C. Space main runners 4'-0" o.c. and space hangers 4'-0" o.c. along runners, except as otherwise shown.
D. Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.
E. Metal Furring Channels: Space sixteen (16) inches o.c. maximum. Attach to 1-1/2" main runner channels with furring channel clips (on alternate sides of main runner channels). Furring channels shall not be let into or come in contact with abutting masonry walls. End splices shall be provided by nesting furring channels no less than eight (8) inches and securely wire tying. At any openings that interrupt the furring channels, install additional cross reinforcing to restore lateral stability.
F. Mechanical accessories, hangers, splices, runner channels and other members used in suspension system shall be of metal, zinc coated, or coated with rust inhibitive paint, of suitable design and of adequate strength to support units securely without sagging, and such as to bring unit faces to finished indicated lines and levels.
   1. Provide special furring where ducts are over two (2) feet wide.
G. Apply board with its long dimension at right angles to channels. Locate board butt joints over center of furring channels. Attach board with one (1) inch self-drilling drywall screws twelve (12) inches o.c. in field of board at each furring channel; eight (8) inches o.c. at butt joints located not less than 3/8" from edges.

3.6 ERECTION AT COLUMN ENCLOSURES

A. Metal furring supports shall be provided under work of this Section, and shall be cut to lengths as necessary for tight fit such that spacing is not more than sixteen (16) inches o.c.
B. Board shall be fastened securely to supports with screws as specified. Place boards in position with minimum number of joints. Where free ends occur between supports back-blocking or furring shall be required. Center abutting ends over supports. Correct work as necessary so that faces of boards are flush, smooth and true. Provide clips or cross furring for attachment as required.
C. All layers shall be screw attached to furring.
D. When column finish called for on drawings to be in the same plane as drywall finish layer, maintain even, level plane.

3.7 FINISHING

A. Taping: A thin, uniform layer of compound shall be applied to all joints and angles tocbe reinforced. Reinforcing tape shall be applied immediately, centered over the joint, seated into the compound. A skim coat shall follow immediately, but shall not function as a fill or second coat. Tape shall be properly folded and embedded in all angles to provide a true angle.
B. Filling: After initial coat of compound has hardened, additional compound shall beapplied, filling the board taper flush with the surface. The fill coat shall cover the tape and feather out slightly beyond the tape. On joints with no taper, the fill coat shall cover the tape and feather out at least four (4) inches on either side of the tape. No fill coat is necessary on interior angles.
C. After compound has hardened, a finishing coat of compound shall be spread evenly over and extending slightly beyond the fill coat on all joints and feathered to a smooth, uniform finish. Over tapered edges, the finished joint shall not protrude beyond the plane of the surface. All taped angles shall receive a finish coat to cover the tape and taping compound and provide a true angle. Where necessary, sanding shall be done between coats and following the final application of compound to provide a smooth surface, ready for painting.
D. Fastener Depressions: Compound shall be applied to all fastener depressions followed, when hardened by at least two (2) coats of compound, leaving all depressions level with the plane of the surface.
E. Finishing Beads and Trim: Compound shall be applied to all bead and trim and shall be feathered out from the ground to the plane of the surface. When hardened, this shall be followed by two (2) coats of compound each extending slightly beyond the previous coat. The finish coat shall be feathered from the ground to the plane of the surface and sanded as necessary to provide a flat, smooth surface ready for decoration.
F. Except as otherwise noted, level of finish for surface exposed to view shall conform to Level 4 of ASTM C 840 and GA-214 of the Gypsum Association.
   1. For drywall boards with fiberglass facing, provide Level 5 finish of ASTM C 840 and GA-214.
G. Drywall construction with defects of such character which will mar appearance of finished work, or which is otherwise defective, will be rejected and shall be removed and replaced at no expense to the Owner.

3.8 CLEANING AND ADJUSTMENT

A. At the completion of installation of the work, all rubbish shall be removed from the building, leaving floors broom clean. Excess material, scaffolding, tools and other equipment shall be removed from the building.
B. Work shall be left in clean condition ready for painting or wall covering. All work shall be as approved by Architect.
C. Cutting and Repairing: Include all cutting, fitting and repairing of the work included herein in connection with all mechanical trades and all other trades which come in conjunction with any part of the work and leave all work complete and perfect after all trades have completed their work.

3.9 PROTECTION OF WORK

A. Installer shall advise Contractor of required procedures for protecting drywall work from damage and deterioration during remainder of construction period.

END OF SECTION

SECTION 093000

CERAMIC TILE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the ceramic tile as shown on the drawings and/or specified herein, including, but not limited to, the following:
   1. Ceramic floor tile.
   2. Ceramic glazed wall tile and matching base.
   3. Stone saddles.
   4. Setting beds, grout and sealant.

1.3 RELATED SECTIONS

A. Gypsum drywall - Section 092900.

1.4 REFERENCES

A. ANSI A108 Series/A118 Series - American National Standards for Installation of Ceramic Tile.
B. ANSI A136.1 - American National Standards for Organic Adhesives for Installation of Ceramic Tile.
C. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
D. ASTM C 150 - Standard Specification for Portland Cement.
E. TCNA - Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America, latest 2021 Edition.
F. ISO 13007 - International Standards Organization; classification for Grout and Adhesives.
G. LFT Tile – Large Format Tile, tile 15” or larger in any one direction.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers: For cutting, installing and grouting of ceramic tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this work, and the recommendations contained in the referenced standards, and the installers are Certified Ceramic Tile Installer (CTI) through the Ceramic Tile Education Foundation (CTEF) or Tile Installer Thin Set Standards (ITS) verification through the University of Ceramic Tile and Stone.
B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the following:
   1. Manufacture all tile in accordance with Standard Grade Requirements of ANSI A-137.1.
   2. Install all ceramic tile in accordance with the recommendations contained in Handbook for Ceramic, Glass and Stone Tile Installation of the Tile Council of North America, Inc., latest edition noted herein and ANSI A108/A118/A136.
   3. Stone tiles shall conform to the requirements of ASTM C1242.
C. Flooring surfaces shall have a minimum wet DCOF AcuTest value of 0.42 and tested per ANSI A326.3 Dynamic Coefficient of Friction of Hard Surface Flooring Materials.

1.6 SUBMITTALS

A. Samples
   1. Before any ceramic tile is delivered to the job site, submit to the Architect sample panels, approx. 12" x 12", mounted on hardboard back-up with selected grout color for each color and pattern of ceramic tile and grout specified.
   2. Submit 6" length of stone saddles.
   3. Submit 12" x 12" samples of waterproofing membrane.

B. Master Grade Certificates: Prior to opening ceramic tile containers, submit to the Architect a Master Grade Certificate, signed by an officer of the firm manufacturing the ceramic tile used, and issued when the shipment is made, stating the grade, kind of tile, identification marks for tile containers, and the name and location of the project.
C. Mock-ups
1. At an area on the site where approved by the Architect, provide a mock-up ceramic tile installation.
a. Make the mock-up approximately 3 feet x 3 feet in dimension.
b. Provide one mock-up for each type, class, and color of installation required under this Section.
c. The mock-ups may be used as part of the Work, and may be included in the finished Work, when so approved by the Architect.
d. Revise as necessary to secure the Architect's approval.
2. The mock-ups, when approved by the Architect, will be used as datum for comparison with the remainder of the work of this Section for the purposes of acceptance or rejection.
3. If the mock-up panels are not permitted to be part of the finished Work, completely demolish and remove them from the job site upon completion and acceptance of the work of this Section.

1.7 PRODUCT HANDLING

A. Delivery and Storage
1. Deliver all materials of this Section to the job site in their original unopened containers with all labels intact and legible at time of use.
2. Store all materials under cover in a manner to prevent damage and contamination; store only the specified materials at the job site.
B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
C. Maintain temperatures at not less than 50 deg. F. in tiled areas during installation and for 7 days after completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof/crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
1. Stone thresholds.
2. Waterproof membrane.
3. Metal edge strips.

2.2 WALL TILE AND BASE

A. Provide wall tile as scheduled on the drawings.
B. Provide sanitary cove base to match wall tile.

2.3 FLOOR TILE

A. Provide floor tile with all-purpose edge as scheduled on the drawings. Tile to have water absorption not to exceed 0.5%.
B. Provide non-slip tile where scheduled, of same characteristics as ceramic mosaics specified herein with the addition of 7-1/2% abrasive grain by weight.

2.4 TRIM AND SPECIAL SHAPES

A. Provide external and internal corners, trim shapes at openings, and all other trim and special shapes to match the tile specified herein, as required by field conditions and drawing details.
B. Metal Trim: Type 304 stainless steel, DECO by Schluter or approved equal.

2.5 STONE SADDLES

A. Provide sound stone saddles as selected by the Architect, minimum 3/4" thick, with an abrasive hardness of not less than 10.0, when tested in accordance with ASTM C 241. Cut saddle to fit jamb profile, honed finish.

2.6 MORTAR BED, BOND COAT AND GROUT

A. Portland Cement: ASTM C 150, Type I.
B. Hydrated Lime: ASTM C 207, Type S.
C. Sand: ASTM C 144, clean and graded natural sand.
D. Latex – Portland Cement Bond Coat, complying with ANSI A118.15 and ISO 13007, C2ES1P1 with minimum compressive strength of 400 psi.
   1. Laticrete, 254 Platinum
   2. MAPEI, Keraflex Super.
   3. Pro Spec – Permalastic System consisting of Permalastic Dryset Mortar and Permalastic Admixture
   4. SikaTile 350 Flex Set
E. Improved Modified Cement Mortars, complying with ANSI 118.15 and ISO 13007, CSES1P1. (Also for use with LFT Tile and Stone Tile)
   1. Laticrete, MultiMax Lite
   2. Mapei; Keraflex Super.
   3. SikaTile 475 LHT Premium Set or SikaTile 500 LHT Lite (above products are lightweight and non-lightweight)
   4. Bostik, BAM
F. Wall and Base Tile
   1. Over drywall use ANSI A136.1-1967 Organic Adhesive for installation of Ceramic Tile, Type I and ISO 13007 D2TE. Shear strength shall be 50 psi minimum. Adhesive primer as recommended by adhesive manufacturer. Manufacturer shall certify, in writing, that adhesive and primer used are proper types for the intended tile types and application. Conform to TCNA Detail W-242.
      a. Laticrete Premium 15 Adhesive.
      b. MAPEI Type 1 Mastic.
      c. ProSpec B-1000 Tile Adhesive
      d. Bostik Multi-Purpose Floor & Wall Mastic
   2. Over concrete use a mortar bed leveling coat conforming to ANSI A108.1A followed by a Latex Portland Cement Bond Coat, Laticrete TriLite, MAPEI, Keraflex Super or Ultralite Mortar, SikaTile 475 LHT Premium Set and for non- LHT SikaTile 350 Flex Set or equal by Pro Spec, Bostik Big Tile & Stone conforming to ANSI A118.15, ISO 13007-C2ES1P1, and TCNA Detail W-211.
   3. Over glass mat water resistant gypsum backer board use a Latex Portland cement mortar bond coat, Laticrete TriLite, MAPEI, Keraflex Super or Ultralite Mortar, SikaTile 475 LHT Premium Set and for non-LHT SikaTile 350 Flex Set or equal by Pro Spec, conforming to ANSI A118.15, ISO 13007-C2ES1P1, and TCNA Detail W-245.
G. Floor Tile and Stone Saddle - Waterproof Setting Bed: Set floor tile and stone saddle using thin set latex Portland cement bond coat, Basis of Design, Laticrete 254 Platinum, MAPEI, Keraflex Super SikaTile 350 Flex Set, Bostik Big Tile & Stone conforming to TCNA Detail F-122/122A.
   1. For installation of (LFT and Stone Tile), Improved Modified Cement Mortars and medium bed, Basis of Design, Laticrete MultiMax Lite, MAPEI, Ultraflex LFT SikaTile 475 LHT Premium Set, Bostik BAM, conforming to ANSI 118.15, ISO 13007-C2ES1P1.

H. Waterproofing Membrane complying with ANSI A118.10 and ANSI A118.12; and having IAPMO certification as a shower pan liner: “Hydro Ban” made by Laticrete International, “Mapelastic Aquadefense” by MAPEI with factory blended “Bio-Block Antimicrobial”, SikaTile 100 Moisture Guard or ProSpec B6000. Bostik GoldPlus
   1. Reinforce membrane with polyester fabric where recommended by manufacturer.
I. Water: Clean, fresh and suitable for drinking.
J. Grout complying with A118.7; and ISO 13007, CG2WAF: For grouting ceramic tile, provide a commercial Portland cement grout “Laticrete PermaColor or Laticrete PermaColor Select”, SikaTile 815 Secure Grout or “Ultracolor Plus FA” (additive not required) made by MAPEI; (addition not required) Bostik Hydroment Vivid; color as selected by the Architect.
K. Physical Properties: The setting beds and grouts must meet the following physical requirements:
   1. Compressive Strength – 3000 psi min.
   2. Shear Bond Strength – 500 psi min.
   3. Water Absorption – 4.0% max.
   4. Service Rating (ASTM C 627) – Extra Heavy Duty.
L. Sealer: Seal all grout joints and all unglazed tile using “StoneTech Heavy Duty Sealer” by Laticrete, “Sealer’s Choice 15 Gold” by Aqua Mix Inc or “Ultracare Penetrating Plus Stone, Tile, and Grout Sealer” by MAPEI. Merkrete Grout Sealer
M. Temporary Protective Coating: Either product indicated below that is applied in the tile manufacturer’s factory and formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, applied hot, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg. F. per ASTM D 87.
   2. Grout release in form of manufacturer’s standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
N. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, equal to “StoneTech Stone & Tile Cleaner” by Laticrete, “Concentrated Stone & Tile Cleaner” made by Aqua-Mix, “Ultracare Concentrated Tile & Grout Cleaner” by MAPEI, or approved equal, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 SEALANT

A. Joint Backing: Preformed, compressible, resilient, non-extruding, non-staining strips of foam neoprene, foam polyethylene, or other material recommended by sealant manufacturer.
B. Bond Breaker: Polyethylene tape, 3 mils thick or other material recommended by sealant manufacturer.
C. Sealant Primer: Colorless, non-staining, or type to suit substrate surface, as recommended by sealant manufacturer.
D. Sealant: One-part silicone based sanitary sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25. Sealant hardness upon full cure shall be between 20-30 Shore "A" Durometer. Color of sealant to blend with or match adjacent materials, and as selected by the Architect. Sealant shall be equivalent to 1700 Sanitary Sealant made by General Electric or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where ceramic tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels
   1. Floors: + 1/8" in 10'-0" distance and 1/4" total max. variation from levels shown.
B. Grind or fill concrete and masonry substrates as required to comply with allowable variations.
C. Concrete substrates must meet ANSI A108.01 tolerances and surface textures in preparation for tile work; coordinate with concrete trades.

3.3 PREPARATION

A. Coordinate the following with Section 035416:

1. Steel trowel and fine broom finish concrete slabs that are to receive ceramic tile. Cure concrete slabs that are to receive tile before tile application. Do not use liquid curing compounds or other coatings that may prevent bonding of tile setting materials to slabs. Slab shall be dry at time of tile installation.
2. Tile floors with floor drains must have a slope to direction of 1/4” per foot; coordinate this with concrete trades.

B. Etch concrete substrate as may be required to remove curing compounds or other substances that would interfere with proper bond of setting bed. Rinse with water to remove all traces of treatment. Surface must meet finish requirements as noted in ANSI 108.01.

C. Blending: for tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at project site before installing.

D. Field Applied Temporary Protective Coating: Pre-coat tile with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.4 JOINTS IN TILE WORK

A. Joint Widths: 1/16" wide in ceramic tile.

B. Alignment: Wall, base and floor joints shall align through the field and trim. Direction and location of all joints as directed by Architect.

C. Movement Joints: Conform to TCNA Detail EJ171. Locate where movement joints are in back-up material. Provide movement joint at joints between mop receptors and ceramic tile. Provide movement joint at all vertical internal joints of wall tile. Movement joints 1/8" wide in ceramic tile. Fill all movement joints with specified backing and sealant. Use bond breaker where sufficient space for joint backing does not exist.

1. Provide sealant between ceramic tile and plumbing fixtures, mirrors, pipes, countertops and other dissimilar materials penetrating or adjacent to ceramic tile.

3.5 INSTALLATION

A. Comply with the following installation standards

1. Wall tile over drywall using organic adhesive - ANSI A136.1 and ISO 13007, D2TE.
2. Wall tile over glass mat backer board using dry set mortar with latex additive - ANSI A118.15 and ISO 13007, C2ES1P1.
3. Wall tile over masonry or concrete using dry set mortar with latex additive – ANSI A118.15 and ISO 13007, C2ES1P1.
4. Floor tile using full mud set mortar - ANSI A118.15, and ISO 13007, C2ES1P1.
5. Floor tile using dry set mortar with latex additive - ANSI A118.15, and ISO 13007, C2ES1P1.
6. Floor tile over waterproofing membrane.- A118.15, and ISO 13007, C2ES1P1.

B. Backs of tile must be cleaned before installation.

C. All setting beds and/or adhesives shall provide for an average contact area of not less than 95% coverage.

D. Allowable Variations in Finished Work: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes and alignment shown.

1. Floors: 1/8" in 10'-0" run, any direction; +/- 1/8" at any location; 1/32" offset at any location.
2. Walls: 1/8" in 8'-0" run, any direction; 1/8" at any location; offset at any location, 1/32".
3. Joints: +/- 1/32" joint width variation of any location; 1/16" in 3'-0" run deviation from plumb and true.

E. Waterproofing Membrane

1. Install the membrane in strict accordance with manufacturer's written recommendations.
2. Upon completion of work, test horizontal membrane for leaks by flood testing per ASTM D 5957. Inspect for leakage. Make necessary adjustments to stop all leakage and retest until watertight. If membrane is not covered by another surface immediately, provide protection until membrane is covered.

F. Handle, store, mix and apply setting and grouting materials in compliance with the manufacturer's instructions.

G. Extend tile work into recesses and under equipment and fixtures, to form a complete covering without interruptions. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignment.

H. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Fit tile closely to electrical outlets, piping and fixtures so that plates, collars, or covers overlap tile.

I. Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are the same size. Lay out tile work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths.

3.6 INSTALLATION OF STONE SADDLES

A. Install stone saddles cut to profiles and sizes shown, accurately fitted to jambs, coped at stops, set in full bed of mortar herein specified, and with grouted edge joints as specified for floor tile.

3.7 CLEANING AND PROTECTION

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use cleaners only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning to insure removal of all cleaning material.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Apply coat of sealer to all grout joints and all unglazed tile.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings from tile surfaces.

E. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.

END OF SECTION

SECTION 09 65 19.19

RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

B. Related Documents
1. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.

C. Related Sections:
1. Other Division 9 sections for floor finishes related to this section but not the work of this section
2. Division 3 Concrete; not the work of this section
3. Division 6 Wood and Plastics; not the work of this section
4. Division 7 Thermal and Moisture Protection; not the work of this section

1.2 REFERENCES

A. ASTM International:
1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
6. ASTM F 1861 Standard Specification for Resilient Wall Base
7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

B. National Fire Protection Association (NFPA):
1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

C. Canadian Standards
1. CAN/ULC-S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide flooring which has been manufactured, fabricated, and installed to performance criteria certified by manufacturer without defects, damage, or failure.

B. Administrative Requirements
1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
2. Pre-installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e., moisture tests, bond test, pH test, etc)

C. Test Installations/Mock-ups: Install at the project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.
   1. Mock-Up Size: [Specify mock-up size.]
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into the final construction with Owner's approval.

D. Sequencing and Scheduling
   1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
   2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.4 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.
B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.
C. Submit Safety Data Sheets (SDS) available for adhesives, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.
D. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
E. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Warranty: Warranty documents specified herein

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.
B. Select an installer who is experienced and competent in the installation of Armstrong resilient vinyl composition tile flooring and the use of Armstrong Flooring subfloor preparation products.
   1. Engage installers certified as Armstrong Commercial Flooring Certified Installers
   2. Confirm installer's certification by requesting their credentials
C. Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
   1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
   2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
   3. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with Division 1 Product Requirements Sections
B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from

freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.7 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65º F (18º C) and a maximum temperature of [100º F (38º C)] for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55º F (13º C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to product installation recommendations for a complete guide on project conditions.

1.8 LIMITED WARRANTY

A. A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
B. Limited Warranty Period: 20 years
C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

1.9 EXTENDED SYSTEM LIMITED WARRANTY

A. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.
B. Limited Warranty Period: 20 years on top of the Resilient Flooring Limited Warranty.
C. [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ flexible patching and smoothing compound] [S-464 Prime Strong™ acrylic primer for porous substrates] [S-465 NP Prime Strong™ epoxy primer for non-porous substrates] [S-462 Seal Strong™ two-part moisture mitigation system].
D. The installation of an Armstrong Flooring product along with the recommended Armstrong Flooring adhesive, as well as any one of the Strong System subfloor preparation products listed above, provides 10 additional years of limited warranty coverage. The Strong System limited warranty covers the installation integrity for the length of the flooring product warranty plus 10 years. To qualify for the Strong System Warranty, any subfloor preparation product needed for an installation must be an Armstrong Flooring product.
E. For the System Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.
F. When Armstrong Flooring Strong System subfloor preparation products are used with other manufacturers' floor coverings, adhesives, or other subfloor preparation products, Armstrong Flooring warrants our products to be free from manufacturing defects from the date of purchase through the limited warranty period of 20 years.

1.10 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Quantity: Furnish quantity of flooring units equal to [ ] % of amount installed.
   2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage, and protection of extra material.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Resilient tile flooring, wall base, adhesives and subfloor preparation products and accessories:
1. AHF Products, 3840 Hempland Road, PO Box 566, Mountville, PA USA 17554 www.armstrongflooring.com/commercial
2. Manufacturer must have a headquarters in the United States of America.

2.2 RESILIENT TILE FLOORING MATERIALS

A. Provide Vinyl Composition Tile: Standard Excelon® Imperial® Texture Tile Flooring manufactured by AHF Products.
1. Description: Tile composed of polyvinyl chloride resin, plasticizers, fillers, stabilizers and pigments with colors and texture dispersed uniformly throughout its entire thickness.
2. Vinyl composition tile shall conform to the requirements of ASTM F 1066, “Standard Specification Vinyl Composition Floor Tile", Class 2, through-pattern
3. Pattern and Color: in [%COLOR%] [color selected from the range currently available from AHF Products]
4. Size: 12 in. x 12 in. (305 mm x 305 mm)
5. Thickness: [1/8 in./0.125 in. (3.2 mm)]

2.3 PRODUCT SUBSTITUTION

A. Substitutions: No substitutions permitted because of the specific attributes listed in Section 2.02.

2.4 WALL BASE MATERIALS

A. For top set wall base: [Provide 1/8 in. (3.18 mm) thick, 4 in. (10.16 cm) high Armstrong Flooring Wall Base with a matte finish, conforming to ASTM F 1861, Type TP - Rubber, Thermoplastic, Group 1 - Solid, Style B – Cove.] [Provide 1/4 in. (6.35 mm) thick, 4.5 in. (11.43 cm) high Armstrong Flooring Color-Integrated Wall Base with a matte finish, conforming to ASTM F 1861, Type TP - Rubber, Thermoplastic, Group 1 - Solid, Style A – Straight.]

2.5 ADHESIVES

A. For Tile Installation System, Full Spread: Provide Armstrong [S-515 Floor Tile Adhesive] [S-525 Adhesive] under the tile and Armstrong S-730 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.
B. [For Tile Installation System, Tile On: Provide Armstrong [S-515 Floor Tile Adhesive] [S-525 Adhesive] under the tile over smooth, completely bonded existing resilient flooring and Armstrong S-730 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer].
C. [For Tile High-Moisture Installation Warranty, Full Spread: Provide Armstrong [S-515 Floor Tile Adhesive] [S-525 Adhesive] under the tile and Armstrong S-730 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer].
D. [Provide Armstrong S-1000 Flooring Adhesive under the flooring and Armstrong S-730 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer].

2.6 ACCESSORIES

A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound].
B. [For priming porous substrates to aid in adhesive bond strength and reducing subfloor porosity, provide S-464 Prime Strong™ acrylic primer for porous substrates. For non-porous substrates, provide S-465 NP Prime Strong™ epoxy primer for non-porous substrates].

C. [For creating a moisture barrier, provide S-462 Seal Strong™ two-part moisture mitigation system].
D. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
E. Provide transition/reducing strips tapered to meet abutting materials.
F. Provide threshold of thickness and width as shown on the drawings.
G. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl, or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.
H. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e., moisture tests, bond test, pH test, etc.).
B. Visually inspect flooring materials, adhesives, and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.
C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates regarding conditions existing at the time of installation.

3.3 PREPARATION

A. [Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong Flooring [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound] [S-464 Prime Strong™ acrylic primer for porous substrates] [S-465 Prime Strong™ epoxy primer for non-porous substrates] as recommended by the flooring manufacturer. Refer to Armstrong Flooring Guaranteed Installation Systems and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.]
B. [Subfloor Preparation Moisture Mitigation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, mitigate moisture and other defects with Armstrong Flooring [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound] [S-462 Seal Strong™ two-part moisture mitigation system] [S-

464 Prime Strong™ acrylic primer for porous substrates] [S-465 Prime Strong™ epoxy primer for non-porous substrates] as recommended by the flooring manufacturer. Refer to Armstrong Flooring Guaranteed Installation Systems and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.]

C. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers, and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate, they must be mechanically removed prior to the installation of the flooring material. Refer to the Armstrong Flooring Guaranteed Installation Systems and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

D. [For Tile High-Moisture Installation Warranty when using S-515 Adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in situ* Probes”][ASTM F 1869,“Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride”] and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 95%.] [MVER shall not exceed 7 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained].

E. [For Tile High-Moisture Installation Warranty when using S-525 Adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in situ* Probes”][ASTM F 1869,“Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride”] and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 90%.] [MVER shall not exceed 7 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

F. [When using S-1000 Adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes”] [ASTM F 1869,“Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride”] and Bond Tests as described in "Armstrong Flooring Guaranteed Installation System" instructions to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Internal relative humidity of the concrete shall not exceed 100%.] [MVER shall not exceed 14 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained].

G. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

H. Wood subfloors: Armstrong resilient floors are recommended on suspended wood subfloors with a 1/4 in. underlayment (see product installation systems for exceptions) and a minimum of 18 in. of well-ventilated air space below. Armstrong Flooring does not recommend installing resilient flooring on wood subfloors applied directly over concrete or on sleeper-construction subfloors. Loading requirements for subfloors are normally set by various building codes on both local and national levels. Trade associations such as APA–The Engineered Wood Association provide structural guidelines for meeting various code

requirements. Subfloor panels are commonly marked with span ratings showing the maximum center-to-center spacing in inches of supports over which the panels should be placed.

1. Refer to the Armstrong Flooring Guaranteed Installation Systems and ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring for additional information.

I. Wood subfloors - Surface Cleaning: Make subfloor free from dust, dirt, grease, and all foreign materials.

1. Check panels for sources of discoloration such as contamination from paint, varnish, stain overspray or spills, plumbing sealers, asphalt, heater fuel, markers, or potential staining agents such as wood or bark not visible on the surface, edge sealers, logo markings, printed nail patterns and synthetic patches.
2. Remove old adhesive.
3. Cover adhesive, oil, or wax residue with an appropriate underlayment. If the residue is tacky, place a layer of felt or polyethylene sheeting over it to prevent a cracking sound when walking on the floor.
4. Remove all paint, varnish, oil, and wax from all subfloors. Many buildings constructed before 1978 contain lead-based paint, which can pose a health hazard if not handled properly. State and federal regulations govern activities that disturb lead-based painted surfaces and may also require notice to building occupants. Do not remove or sand lead-based paint without consulting a qualified lead professional for guidance on lead-based paint testing and safety precautions. Armstrong Flooring does not recommend the use of solvents to remove paint, varnish, oil, wax, or old adhesive residues because the solvents can remain in the subfloor and negatively affect the new installation. Whenever sanding, be certain the work site is well ventilated and avoid breathing dust. If high dust levels are anticipated, use appropriate National Institute for Occupational Safety and Health (NIOSH) designated dust respirator. All power sanding tools must be equipped with dust collectors. Avoid contact with skin or eyes. Wear gloves, eye protection and long-sleeve, loose fitting clothes
5. For additional information on the installation and preparation of wood and board-type underlayments see the current edition of ASTM F1482, “Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.”
6. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring.

3.4 INSTALLATION OF FLOORING

A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems. Failure to comply may result in voiding the manufacturer’s warranty listed in Section 1.08.

B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.5 INSTALLATION OF ACCESSORIES

A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths if practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

D. Apply [butt-type] [overlap] metal edge strips where shown on the drawings, [before] [after] flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.6 CLEANING

A. Perform initial and on-going maintenance according to the latest edition of the Maintenance Instructions for Vinyl Composition Tile.

3.7 PROTECTION

A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

END OF SECTION

SECTION 099600

HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes surface preparation and field application of high-performance coating systems to items and surfaces scheduled. Related Sections include the following:
   1. Division 5 Section “Structural Steel” for shop priming structural steel.
   2. Division 5 Section “Formed-Metal Fabrications” for shop-primed ferrous metals.
   3. Division 9 Section “Painting” for general field painting.
   4. Field-applied high-performance coatings for primary structural frame, steel stair elements, railings and architectural metalwork.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this section.

B. Gloss ranges used in this Section include the following:
   1. Semi-gloss refers to medium-sheen finish with a gloss range between 30-65, when measured with a 60* meter.
   2. High gloss refers to a high-sheen finish with a gloss range more than 65 when measured with a 60* meter.

C. Environments: The following terms are used in Part 2 of the Section to distinguish between different corrosive environments.
   1. “Severe Environments” are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using string agents.
   2. “Moderate Environments” are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with string chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.
   3. “Mild Environments” are atmospheres with normal exposures to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with string chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.4 REFERENCES

A. American Architectural Manufacturers Association (AAMA) (www.aamanet.org) 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

B. American Waterworks Association (AWWA) (www.awwa.org) D102 - Coating Steel Water-Storage Tanks.

C. International Organization for Standardization (ISO) (www.iso.org) 2813 - Paints and Varnishes - Determination of Gloss Value at 20 Degrees, 60 Degrees and 85 Degrees.

D. Society for Protective Coatings (SSPC) (www.sspc.org) - Painting Manual.

1.5 SUBMITTALS

A. Product Data: For each coating system indicated, include block fillers and primers
   1. Material List: An inclusive list of required coating materials. Indicated each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instruction for handling, storing, and applying each material specified.

B. Certification by manufacturer that products supplied comply with requirements indicated that limit the number of VOCs in the coating products

C. Samples for Initial Selection: Manufacturer's color charts showing a full range of colors available for each type of finish-coat material included.
   1. After color selection, Architect will furnish color chips for surfaces to be coated: Coating manufacturer's descriptive data and test results for coatings.

D. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
   1. Provide stepped samples defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. List of material and application for each coat of each sample. Label each sample for location and application.
   3. Submit samples on the following substrates for Architect's review of color and texture:
      a. Ferrous and Nonferrous Metal: provide two 4" (100mm) square samples of flat metal and two 8" (200mm) long samples of solid metal for each color and finish.

E. Qualification data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists if completed projects with project names and addresses of architects and owners, and other information specified.

F. Retain the following for submission of informational submittals. These submittals are intended for the Owner's record purposes and are not intended to be reviewed by the Design Professional.

G. Informational Submittals:
   1. Certificate of Compliance: Coating manufacturer's certification that coatings applied on Project components comply with referenced AAMA standard.

H. Closeout Submittals:
   1. Maintenance Data: Provide information regarding touch-up, cleaning, and maintenance of coatings.

I. Sustainable Design Submittals: Refer to Division 01.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating systems application similar in material and extent to those indicated for the project whose work has a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system form the same manufacture as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample submittals
   1. Architect will select one area or surface to represent surfaces and conditions of each type of coating and substrate.
      a. Small Areas and Items: Architect will designate items and areas required.
   2. After permanent lighting and other environmental services have been activated, apply coatings to each surface as specified. Provide the required sheen, color, and texture of each surface.
      a. After finishes are accepted, architect will use the surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from benchmark samples.

1.7 DELIVERY STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packages and container bearing manufacturer's name and label with the following information:
   1. Name and Title of Material
   2. Product Description
   3. Manufacturer's Stock Number and Date of Manufacture
   4. Contents by Volume, for Pigment and Vehicle Constituents
   5. Thinning Instructions
   6. Application Instructions
   7. Color name and Number
   8. Handling Instructions and Precautions

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 60* F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and heath hazards resulting from handling, mixing, and applying coatings.

1.8 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 60*-95* F.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85% at temperatures less than 5*F above the dew point; or too damp or wet surfaces.
   1. Allow wet surfaces to dry thoroughly and attain temperatures and conditions specified before proceeding with or continuing coating operations.

C. Except as otherwise specified, materials shall be first-line products of the following manufactures:
   1. Special Coatings:
      a. Tnemec Company

1.9 MATERIALS

A. Products specified are as manufactured by those of Tnemec Company unless otherwise indicated: similar products of acceptable manufacturers listed in Paragraph 1.7 may be furnished in lieu of those listed. Tnemec products are listed to establish a baseline of performance criteria, other manufacturers need to meet or exceed this noted performance.
   1. Quality: Select primary products of the system from the products of a single manufacturer.

PART 2 EXECUTION

2.1 INPECTION OF SURFACES

A. Examine surfaces to be coated and report any conditions that would adversely affect the appearance or performance of the coating system and which cannot be put into acceptable condition by the preparatory work specified herein.

B. Do not proceed with surface preparation and application until surfaces are acceptable. Commencement of application of coating to any surface shall be construed as acceptance or surfaces as being proper to receive the finish, and any defects in the work resulting from such accepted surfaces shall be corrected by the applicator without additional cost to the owner.

2.2 SURFACE PREPARATION

A. General
   1. Dislodge dirt, plaster nibs, plaster splatter and other dry materials by scraping or brushing. Remove dust and loose material by brushing, sweeping, vacuuming, or blowing with high pressure air.

2. Remove oil, wax and grease by scraping off heavy deposits and cleaning with mineral spirits or a hot trisodium phosphate solution followed by a clean water rinse.
3. Verify that surfaces to be coated are dry, clean, and free of dust, dirt, oil, wax, grease, or other contaminants.
4. Apply test patch to existing painted surfaces to check adhesion. Remove any loo paint an spot prime.

B. Surface Preparation: Comply with coating manufacturer's recommendations or following requirements, whichever is more restrictive:
1. Galvanized steel: Power wash with 3,000 pai using a 15 degree tip to remove dirt, dust, and all surface contamination. Power tool clean with 80 grit paper to 100% remove the glossy spangled appearance of the galvanizing and create a surface profile for bonding.

C. Protection: protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting as acceptable to architect.
1. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings proved by others for protection of their work after completion of painting operations .
2. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

2.3 FINISH PIANTING SCHEDULE

A. Exterior Paint Schedule
1. Exterior Galvanized Metal
Coat 1: Tnemec Series V69 Hi-Build Epoxoline 11 shop applied at 4-6 mils DFT. Series V69 needs a surface temperature of 50*F and rising to be applied
Coat 2: Tnemec Series 1095 Endura-Shield Semi-Gloss applied at 3-4 mils DFT. Series 1095 needs a surface temperature of 35* F and rising to be applied.

END OF SECTION

SECTION 09900

PAINTING AND FINISHING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the drawings and/or specified herein, including, but not limited to, the following:
1. Prime painting unprimed surfaces to be painted under this Section.
2. Painting all items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
3. Painting all ferrous metal (except stainless steel) exposed to view.
4. Painting gypsum drywall exposed to view.
5. Painting plaster surfaces.
6. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
7. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
8. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers, lighting fixtures, and the like, which are exposed to view through these items.
9. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
10. Painting of any surface not specifically mentioned to be painted herein or on drawings, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, shall be included as though specified.

1.3 RELATED SECTIONS

A. Shop priming is required on so me, but not all of the items scheduled to be field painted. Refer to other Sections of work for complete description.
B. Shop Coat on Machinery and Equipment: Refer to the Sections under which various items of manufactured equipment with factory applied shop prime coats are furnished including, but not necessarily limited to, the following Sections. All items of equipment furnished with prime coat finish shall be finish painted under this Section.
1. Plumbing - Division 22.
2. Heating, ventilation and air conditioning - Division 23.
C. Color Coding of Mechanical Piping and Electrical Conduits - Divisions 22 and 26.
1. This Color Coding consists of an adhesive tape system and is in addition to painting of piping and conduits under this Section, as specified above.

1.4 MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A. Items of equipment furnished with complete factory finish, except for items specified to be given a finish coat under this Section.
B. Factory-finished toilet partitions.
C. Factory-finished acoustical tile.
D. Non-ferrous metals, except for items specified and/or indicated to be painted.
E. Finished hardware, excepting hardware that is factory primed.
F. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials resulting from the work of this Section.

1.5 QUALITY ASSURANCE

A. Job Mock-Up
   1. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Architect. Paint mock-ups to include door and frame assembly.
   2. These applications when approved will establish the quality and workmanship for the work of this Section.
   3. Repaint individual areas which are not approved, as determined by the Architect, until approval is received. Assume at least two paint mock-ups of each color and gloss for approval.
B. Qualification of Painters: Use only qualified painters for the mixing and application of paint on exposed surfaces.
C. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Architect in writing of any anticipated problems using the coating systems as specified with substrates primed by others.
D. All paints must conform to the Volatile Organic Compounds (VOC) standards of prevailing codes and ordinances.

1.6 SUBMITTALS

A. Materials List
   1. Before any paint materials are delivered to the job site, submit to the Architect a complete list of all materials proposed to be furnished and installed under this portion of the work.
   2. This shall in no way be construed as permitting substitution of materials for those specified or accepted for this work by the Architect.
B. Samples
   1. Accompanying the materials list, submit to the Architect copies of the full range of colors available in each of the proposed products.
   2. Upon direction of the Architect, prepare and deliver to the Architect two (2)identical sets of Samples of each of the selected colors and glosses painted onto 8-1/2" x 11" x 1/4" thick material; whenever possible, the material for Samples shall be the same material as that on which the coating will be applied in the work.
C. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these specifications, submit for the Architect's review the current recommended method of application published by the manufacturer of the proposed material.
D. Close out Submittal
   1. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or plant manufacturer/supplier shall furnish a coating maintenance manual such as Sherwin Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, MSDS, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.7 PRODUCT HANDLING

A. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.
B. Protection
   1. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
   2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
   3. Use all means necessary to protect paint materials before, during and after application and to protect the installed work and materials of all other trades.
C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.8 EXTRA STOCK

A. Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint equaling approximately ten (10) percent of each color and gloss used and each coating material used, with all such extra stock tightly sealed in clearly labeled containers.

1.9 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.
B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.
C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds eighty-five (85) percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
D. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 PRODUCTS

2.1 PAINT MANUFACTURERS

A. Except as otherwise noted, provide the painting products listed for all required painting made by one of the manufacturers listed in the paint schedule (Section 2.4). Alternate companies are Benjamin Moore, PPG Paints (PPG), and Sherwin Williams (S-W). Comply with number of coats and required minimum mil thicknesses as specified herein.

2.2 MATERIALS

A. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.
B. Colors and Glosses: All colors and glosses shall be as selected by the Architect. Certain colors will require paint manufacturer to prepare special factory mixes to match colors selected by the Architect. Color schedule (with gloss) shall be furnished by the Architect.
C. Coloring Pigment: Products of or furnished by the manufacturer of the paint or enamel approved for the work.
D. Linseed Oil: Raw or boiled, as required, of approved manufacture, per ASTM D 234 and D 260, respectively.
E. Turpentine: Pure distilled gum spirits of turpentine, per ASTM D 13.
F. Shellac: Pure gum shellac (white or orange) cut in pure denatured alcohol using not less than four (4) lbs. of gum per gallon of alcohol.
G. Driers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacture.
H. Heat Resistant Paint: Where required, use heat resistant paint when applying paint to heating lines and equipment.

2.3 GENERAL STANDARDS

A. The various surfaces shall be painted or finished as specified below in Article 2.4.
However, the Architect reserves the right to change the finishes within the range of flat, semi-gloss or gloss, without additional cost to the Owner.
B. All paints, varnishes, enamels, lacquers, stains and similar materials must be delivered in the original containers with the seals unbroken and label intact and with the manufacturer's instructions printed thereon.
C. All painting materials shall bear identifying labels on the containers with the manufacturer's instructions printed thereon.
D. Paint shall not be badly settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency and shall have excellent application properties.
E. Paint shall arrive on the job color-mixed except for tinting of under-coats and possible thinning.
F. All thinning and tinting materials shall be as recommended by the manufacturer for the particular material thinned or tinted.
G. It shall be the responsibility of the Contractor to see that all mixed colors match the color selection made by the Architect prior to application of the coating.

2.4 SCHEDULE OF FINISHES

A. Interior Ferrous Metal
Satin Finish/Latex
Primer: Benj. Moore Ultra Spec HP Acrylic Metal Primer (HP04)

PPG Pitt Tech Plus DTM Acrylic Primer 4020 PF
S-W Pro-Industrial Pro-Cryl Universal Primer B66-3100 Series
First Coat: Benj. Moore Ultra Spec-HP DTM Acrylic Low Luster (HP25)
PPG Pitt Glaze WB1 Pre-Catalyzed Eggshell Epoxy 16-310
S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
Second Coat: Benj. Moore Ultra Spec-HP DTM Acrylic Low Luster (HP25)
PPG Pitt Glaze WB1 Pre-Catalyzed Eggshell Epoxy 16-310
S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
a. Total DFT not less than: 3.9 mils

Semi-Gloss Finish/Latex
Primer: Benj. Moore Ultra Spec-HP Acrylic Metal Primer (HP04)
PPG Devflex 4020 PF DTM Primer/Flat Finish
S-W Pro-Industrial Pro-Cryl Universal Primer B66-3100 Series
First Coat: Benj. Moore Ultra Spec HP DTM Acrylic Semi-Gloss (HP29)
PPG Pitt Glaze WB1 Pre-Catalyzed Semi-Gloss Epoxy 16-510
S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
Second Coat: Benj. Moore Ultra Spec HP DTM Acrylic Semi-Gloss (HP29)
PPG Pitt Glaze WB1 Pre-Catalyzed Semi-Gloss Epoxy 16-510
S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
a. Total DFT not less than: 4.0 mils

B. Interior Drywall
Provide paint as scheduled on the drawings or approved equal.
Flat Finish/Vinyl Acrylic Latex
Primer: Benj. Moore Ultra Spec 500 Interior Latex Primer (N534)
PPG Speedhide Zero Interior Latex Primer 6-4900XI
S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
First Coat: Benj. Moore Ultra Spec 500 Latex Flat (N536)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series
Second Coat: Benj. Moore Ultra Spec 500 Latex Flat (N536)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series
a. Total DFT not less than: 3.6 mils

Eggshell Finish/Vinyl Acrylic Latex
Primer: Benj. Moore Ultra Spec 500 Interior Latex Primer (N534)
PPG Speedhide Zero Interior Latex Primer 6-4900XI
S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
First Coat: Benj. Moore Ultra Spec 500 Interior Latex Eggshell (N538)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Eggshell (N538)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
a. Total DFT not less than: 3.8 mils

C. Interior Painted Wood
Satin Finish/Latex
Primer: Benj. Moore Advance Waterborne Int. Alkyd Primer (790)
PPG Seal Grip Int./Ext. Acrylic Universal Primer/Sealer 17-921
S-W Multi-Purpose Latex Primer/Sealer B51 Series
First Coat: Benj. Moore Advance Waterborne Int. Alkyd Satin (792)
PPG Speedhide Zero Interior Latex Satin, 6-4410XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
Second Coat: Benj. Moore Advance Waterborne Int. Alkyd Satin (792)
PPG Speedhide Zero Interior Latex Satin, 6-4410XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
a. Total DFT not less than: 4.0 mils

Semi-Gloss Finish/Latex
Primer: Benj. Moore Advance Waterborne Int. Alkyd Primer (790)

PPG Seal Grip Int./Ext. Acrylic Universal Primer/Sealer 17-921
S-W Multi-Purpose Latex Primer/Sealer B51 Series
First Coat: Benj. Moore Advance Waterborne Int. Alkyd (793)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-4510XI
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
Second Coat: Benj. Moore Advance Waterborne Int. Alkyd (793)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-4510XI
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
a. Total DFT not less than: 3.8 mils

D. Interior Drywall to Receive Wallcovering
Primer: "Shield Z Mold and Mildew Proof Commercial Wallcovering Primer" made by Zinsse
First Coat: Moore One Prep Wallpaper Primer WP-3001 by Insl-X.
Second Coat: Multi-Purpose Interior/Exterior B51-450 by Sherwin Williams

2.5 EXISTING SURFACES TO BE PAINTED

A. Existing surfaces shall be painted in accordance with schedule given in Article 2.4 herein except that first or prime coat may be eliminated where existing paint is sound. Where existing paint must be removed down to base material, provide first or prime coat as specified.

2.6 PIPING AND MECHANICAL EQUIPMENT EXPOSED TO VIEW

A. Paint all exposed piping, conduits, ductwork and mechanical and electrical equipment. Use heat resisting paint when applied to heating lines and equipment. The Contractor is cautioned not to paint or otherwise disturb moving parts in the mechanical systems. Mask or otherwise protect all parts as required to prevent damage.
B. Exposed Uncovered Ductwork, Piping, Hangers and Equipment: Latex Enamel Undercoater and one (1) coat Acrylic Latex Flat.
C. Exposed Covered Piping, Duct Work and Equipment: Primer/Sealer and one (1) coat Acrylic Latex Flat.
D. Panel Boards, Grilles and Exposed Surfaces of Electrical Equipment: Latex Enamel Undercoater and two (2) coats Latex Semi-Gloss.
E. Equipment or Apparatus with Factory-Applied Paint: Refinish any damaged surfaces to match original finish. Do not paint over name plates and labels.
F. All surfaces of insulation and all other work to be painted shall be wiped or washed clean before any painting is started.
G. All conduit, boxes, distribution boxes, light and power panels, hangers, clamps, etc., are included where painting is required.
H. All items of Mechanical and Electrical trades which are furnished painted under their respective Contracts shall be carefully coordinated with the work of this Section so as to leave no doubt as to what items are scheduled to be painted under this Section.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 GENERAL WORKMANSHIP REQUIREMENTS

A. Only skilled mechanics shall be employed. Application may be by brush or roller. Spray application only upon acceptance from the Architect in writing.
B. The Contractor shall furnish the Architect a schedule showing when he expects to have completed the respective coats of paint for the various areas and surfaces. This schedule shall be kept current as the job progresses.
C. The Contractor shall protect his work at all times and shall protect all adjacent work and materials by suitable covering or other method during progress of his work. Upon completion of the work, he shall remove all paint and varnish spots from floors, glass and other surfaces. He shall remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and shall leave his part of the work in clean, orderly and acceptable condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide ample in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Owner.

H. All coats shall be dry to manufacturer's recommendations before applying succeeding coats.

I. All suction spots or "hot spots" in plaster after the application of the first coat shall be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.3 PREPARATION OF SURFACES

A. Existing Surfaces: Clean existing surfaces requiring paint or finishing, remove all loose and flaking paint or finish and sand surface smooth as required to receive new paint or finish. No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, Contractor shall be required to sand smooth and re-finish until surface meets with Architect's approval.

B. General

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished shall be perfectly dry, clean and smooth.
2. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

C. Metal Surfaces

1. Weld Fluxes: Remove weld fluxes, splatters, and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.
2. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces, where solder flux has been used, with benzene. Clean surfaces by flushing with mineral spirits. For aluminum surfaces, wipe down with an oil free solvent prior to application of any pre-treatment.
    a. Bare metal to receive high performance coating specified herein must be blast cleaned SSPC SP-6 prior to application if field applied primer; coordinate with steel trades furnishing ferrous metals to receive this coating to ensure that this cleaning method is followed.
3. Shop Primed Metal: Clean off foreign matter as specified for "Bare Metal." Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.
4. Galvanized Metal: Prepare surface as per the requirements of ASTM D 6386.
5. Metal Filler: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with an approved metal filler suitable for the purpose and meeting the requirements of the related Section of work; after setting, sand to a smooth, hard finish, flush with adjoining surface.

D. Plaster Surfaces: Scrape off all plaster nibs or other projections and sand smooth or finish to match adjoining surface texture. Cut out all scratches, cracks, holes, depressions and similar voids and fill with non-shrinking grout, spackles, patching plaster or other approved patching material; allow to dry, refill if necessary, then sand smooth (or refinish) to provide a flush, smooth surface of the same texture as the adjacent plaster surface.

    1. Allow at least 28 days, from installation of final plaster coat, before starting work.

E. Gypsum Drywall Surfaces: Scrape off all projections and splatters, spackles all holes or depressions, including taped and spackled joints, sand smooth. Conform to standards established in Section 092900, "Gypsum Drywall."

F. Wood Surfaces: Sand to remove all roughness, loose edges, slivers, or splinters and then brush to remove dust. Wash off grease or dirt with an approved cleaner. Fill all cracks, splits, nail holes, screw holes, and surface defects with putty after the priming coat has been applied. Putty shall be brought up flush with the surface and sanded smooth and touched-up with primer when dry.

G. Testing for Moisture Content: Contractor shall test all plaster, masonry, and drywall surfaces for moisture content using a reliable electronic moisture meter. Contractor shall also test latex type fillers for moisture content before

application of top coats of paint. Do not apply any paint or sealer to any surface or to latex type filler where the moisture content exceeds seven (7) percent as measured by the electronic moisture meter.

H. Touch-Up: Prime paint all patched portions in addition to all other specified coats.

3.4 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with the manufacturer's directions.
B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.
C. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.
D. Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.5 APPLICATION

A. General
1. Apply paint by brush or roller in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.
2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone, where required to produce an even, smooth surface in accordance with the coating manufacturer's directions.
3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   a. "Exposed surfaces" is defined as those areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, etc., are in place in areas scheduled to be painted.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.
6. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.
7. Finish doors on tops, bottoms, and side edges the same as the faces, unless otherwise indicated.
8. Enamel finish applied to wood or metal shall be sanded with fine sandpaper and then cleaned between coats to produce an even surface.
9. Paste wood filler applied on open grained wood after beginning to flatten, shall be wiped across the grain of the wood, then with a circular motion, to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface with the grain until smooth before applying specified coat.

B. Scheduling Painting
1. Apply the first coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Prime Coats: Re-coat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
D. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.
E. "Touching-Up" of Factory Finishes: Unless otherwise specified or shown, materials with a factory finish shall not be painted at the project site. To "touch-up," the Contractor shall use the factory finished material manufacturer's recommended paint materials to repair abraded, chipped, or otherwise defective surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing, and repainting, as acceptable to the Architect.
B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.7 CLEAN UP

A. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.
B. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION

SECTION 102800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the project coordination as specified herein, including but not limited to, the following:
   1. Mirrors.
   2. Grab Bars.
   3. Sanitary towel disposal bin.
   4. Seat cover dispenser.
   5. Recessed waste receptacle.

1.3 RELATED SECTIONS

A. Gypsum board partitions - Section 04200.

1.4 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in tile or concrete, coordinate with other work to avoid delay.
B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units. Height of accessories shall be in compliance with prevailing Accessibility Codes and Regulations.
C. Products: Unless otherwise noted, provide products of same manufacture for each type of unit and for units exposed in same areas.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data, catalogue cuts and installation instructions for each toilet accessory.
B. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devises in other work.
C. Submit schedule of accessories indicating quantity and location of each item.

1.6 PRODUCT HANDLING

A. Deliver accessories to the site ready for use in the manufacturer’s original and unopened containers and packaging, bearing labels as to type or material, manufacturer’s name and brand name. Delivered materials shall be identical to approved samples.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gauge minimum, unless otherwise indicated.

B. Galvanized Steel Sheet: ASTMI
C. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B456, Type SC 2.
D. Mirror Glass: FS DD-G-451, Type I, Class 1, Quality q1, 1/4" thick, with silver coating, copper protective coating, and non-metallic paint coating complying with FS DD-M-411.
   1. Mirror Fasteners:
      a. Bottom Support: Continuous stainless steel unequal leg channel.
      b. Top Support: Stainless steel or chrome plated clips, with fasteners not exposed to view.

2.2 FASTENING DEVICES

A. Exposed Fasteners: chrome plated, or stainless steel; match finishes on which they are being used.
B. Concealed Fasteners: Galvanized (ASTM A386) or cadmium plated.
C. No exposed fastening devices permitted on exposed frames.
D. For metal stud drywall partitions, provide ten (10) gauge galvanized sheet concealed anchor plates for securing surface mounted accessories.

2.3 FABRICATION

A. General: Stamped names or labels on exposed faces of toilet accessory units are not permitted. Unobtrusive labels on surfaces not exposed to view are acceptable. Where locks are required for a particular type of toilet accessory, provide same keying throughout project. Furnish two keys for each lock.
B. Surface-Mounted Toilet Accessories, General: Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage.

2.4 MANUFACTURERS

A. Provide products manufactured by Kohler, Bobrick.

2.5 ACCESSORY SCHEDULE

A. Accessories (see equipment fixture schedule for model numbers)
   1. Mirrors by glazier (custom).
   2. Grab bars by Kohler.
   3. Sanitary towel disposal bin by Bobrick.
   4. Seat cover dispenser by Bobrick.
   5. Recessed waste receptacle by Bobrick.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where toilet accessories are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION

A. Accessories which are to be partition mounted shall be closely coordinated with other trades, so that the necessary reinforcing is provided to receive the accessories.
B. Furnish templates and setting drawings and anchor plates required for the proper installation of the accessories at gypsum drywall and masonry partitions. Coordinate the work to assure that base plates and anchoring frames are in the proper position to secure the accessories.
C. Verify by measurements taken at the job site those dimensions affecting the work. Bring field dimensions which are at variance with those on the approved shop drawings to the attention of the Architect. Obtain decision regarding corrective measures before the start of fabrication of items affected.

D. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

3.3 INSTALLATION

A. Install accessories at locations indicated on the drawings, using skilled mechanics, in a plum, level and secure manner.
B. Concealed anchor assemblies for gypsum drywall partitions shall be securely anchored to metal studs to accommodate accessories. Assemblies shall consist of plates and/or angles tack welded to studs.
C. Secure accessories in place, at their designated locations by means of theftproof concealed set screws, so as to render removing of the accessory with a screwdriver impossible.
D. Unless otherwise indicated, accessories shall conform to heights from the finished floor as shown on the drawings. Where locations are not indicated, such locations shall be as directed by the Architect.
E. Installed accessories shall operate quietly and smoothly for use intended. Doors and operating hardware shall function without binding or unnecessary friction. Dispenser type accessories shall be keyed alike. Prior to final acceptance, master key and one duplicate key shall be given to Owner's authorized agent.
F. The Architect shall be the sole judge of workmanship. Workmanship shall be of the highest quality. Open joints, weld marks, poor connections, etc., will not be permitted. The Architect has the right to reject any accessory if he feels the workmanship is below the standards of this project.
G. Grab bars shall be installed so that they can support a three hundred (300) lb. load for five minutes per ASTM F446.

3.4 CLEANING AND PROTECTION

A. Upon completion of the installation, clean accessories of dirt, paint and foreign matter.
B. During the installation of accessories and until finally installed and accepted, protect accessories with gummed canvas or other means in order to maintain the accessories in acceptable condition.
C. Replace and/or repair installed work which is damaged or defective to the Owner's satisfaction, at no additional cost.

END OF SECTION

SECTION 142423

ELEVATOR

PART 1 - GENERAL

1.1 Description

A. Work Included: The extent of the work is indicated on the drawings.

B. The work of this Section includes labor, materials, tools, equipment, appliances and services required to manufacture, deliver and install the units complete as shown on the drawings, as specified herein, and/or as required by job conditions.

C. The work and /or requirements specified in all sections is described in singular with the understanding that identical work shall be performed on all units or associated systems unless otherwise specified herein.

D. Elevator Contractor Note: The elevator specified herein is custom due to Architectural and Structural constraints. The cab and hoistway dimensions are not the industry standard for a 3,00# capacity elevator. See VDA drawings and Architectural drawings for dimensional information.

E. The work shall include, but is not limited to the following:

1. One (1) 3,000 lbs. capacity machine room-less traction passenger elevator operating at 200 fpm – Car PE1

F. Related Sections

1.	Division 01:	Protecting hoistway during installation of equipment
2.	Division 01:	Clear, plumb, substantially flush hoistway with variations not to exceed more than 1” at any point.
3.	Division 01:	Bevel cants not less than 75° from the horizontal on any rear or side wall ledges or beams that project or recess more than 4” into the hoistway. Not required on hoistway divider beams.
4.	Division 03:	Cutting and patching.
5.	Division 03:	Concrete pits and slabs.
6.	Section 03 60 00:	Grouting under hoistway door sills.
7.	Section 05 12 00:	Structural steel hoist beam within the hoistway overhead.
8.	Division 05:	Concrete wall pockets and/or structural steel beams for support of hoist machine, rope sheaves, and dead-end hitch beams. Support deflection shall not exceed 1/1666 of span under static load.
9.	Section 05 50 00:	Access Ladders, railing and inspection platforms, intermediate support members, sump pit covers.
10.	Section 05 70 00:	Interior Ornamental Metals.
11.	Division 07:	Elevator pit waterproofing.
12.	Division 08:	Lockable, self-closing, self-locking fire rated control room access door.
13.	Section 08 80 00:	Interior Glass and Glazing.
14.	Section 09 20 00:	Shaft and control room walls.
15.	Section 09 60 00:	Finished flooring.
16.	Division 23:	Ventilation or pressurization of hoistway and control room as required by building code, and fire extinguisher in control room.
17.	Division 26:	Power feeders to starter panels through fused main line switches. Additional main line switches adjacent to each hoist machine in overhead area (MRL).
18.	Division 26:	Branch circuits through fused disconnects for car lights.
19.	Division 26:	Lights and GFI receptacles in control] room, overhead, and pit.

20.	Division 26:	Signal wiring from smoke detectors to a junction box in the control room.
21.	Division 26:	Empty conduit runs for wiring required to monitor elevator from a central location.
22.	Division 26:	Shunt trip devices to automatically disconnect the main power supply to the elevators prior to the activation of sprinkler system.
23.	Division 27:	Card reader and CCTV Systems, device and their interface with the elevator system.
24.	Division 27:	Telephone communications wiring terminated in a junction box located next to the controller.
25.	Division 27:	Ethernet port in the elevator control room, fire command center and building engineer's office.

G. Abbreviations and Symbols

1. The following abbreviations, Associations, Institutions, and Societies may appear in the Project Manual or Contract Documents:

ADA	Americans with Disabilities Act
AHJ	Authority Having Jurisdiction
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Agency
OSHA	Occupational Safety and Health Act

H. Codes and Ordinances / Regulatory Agencies

1. Work specified by the Contract Documents shall be performed in compliance with applicable Federal, State, and municipal codes and ordinances in effect at the time of Contract execution. Regulations of the Authority Having Jurisdiction shall be fulfilled by the Contractor and Subcontractors. The entire installation, when completed, shall conform with all applicable regulations set forth in the latest editions of:

   a. Local and/or State laws applicable for logistical area of project work.
   b. 2018 North Carolina Building Code
   c. Safety Code for Elevators and Escalators, ASME A17.1 2019 and all supplements as modified and adopted by the AHJ.
   d. Safety Code for Elevators and Escalators, A17.1S supplement to A17.1 as modified and adopted by the AHJ for Machine Room Less installations (MRL).
   e. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2
   f. Guide for Emergency Evacuation of Passengers from Elevators, ASME A17.4.

g. National Electrical Code (ANSI/NFPA 70).
h. American with Disabilities Act - Accessibility Guidelines for Buildings and Facilities and/or A117.1 Accessibility as may be applicable to the AHJ.
i. ASME A17.5/CSA-B44.1 - Elevator and Escalator Electrical Equipment.
j. ECC (Energy Conservation Code) as may be applicable to the AHJ.

2. The Contractor shall advise the Owner's Representative of pending code changes that could be applicable to this project and provide quotations for compliance with related costs.

I. Reference Standards

1. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. ANSI/AWS D1.1 - Structural Welding Code, Steel.
3. ANSI/NFPA 80 - Fire Doors and Windows.
4. ANSI/UL 10B - Fire Tests of Door Assemblies.
5. ANSI/IEEE - 519-Latest Edition
6. ANSI/IEEE - Guide for Surge Withstand Capability (SWC) Tests
7. ANSI Z97.1 – Laminated/Safety Tempered Glass

J. Definitions

1. Defective Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Provide: Where used in this document, provide shall mean to install new device, apparatus, system, equipment or feature as specified in this document.
3. Definitions in ASME A17.1 as amended or modified by the AHJ apply to work of this Section.

1.2 PERMITS AND SUBMITTALS

A. Permits

1. Prior to commencing work specified by the Contract Documents, the Contractor shall, at its own expense, obtain all permits or variances as may be required by the AHJ and provide satisfactory evidence of having obtained said permits and variances to both the Owner's Representative and Consultant.
2. File necessary drawings for approval of all Authorities Having Jurisdiction.

B. Submittals

1. Submit the following:

a. Samples

Item No.	Quantity	Size	Description
S1	3	4" x 4"	Exposed finishes as requested by Architect
S2	2	Actual	Car and hall button
S3	2	Actual	Braille plates

b. The samples shall be:

1) Held on site after inspection and used as a standard for acceptance or rejection of subsequent production units.
2) Labeled to identify their intended use and relation to the documents, e.g., car finishes, control panel, etc.
3) Returned to the elevator contractor at the completion of the project.

Subject to approval, where an item of equipment is a standard item, copies of the manufacturer's catalogue or brochure may be accepted provided that all dimensions and relevant information are shown in the catalogue or brochure.

c. Shop Drawings - Submit computer generated project specific layout drawings for approval. Include the following:

1) A listing of all components, devices and sub-systems including:

a) Manufacturer and location of plant
b) Size and model number

2) Machine space plan indicating:

a) Location of equipment
b) Service connections
c) Reactions

3) Control Room Plan indicating:

a) Location of equipment and code clearances
b) Service connections and disconnect switches
c) Passenger rescue and brake release
d) CCTV provisions

4) Fully dimensioned hoistway plan, pit plan, and section of each unit indicating:

a) Platform (with cab), hoistway and entrance dimensions
b) All running clearances
c) Location of fixtures
d) Buffers, service ladders and pit reactions
e) Location of inserts
f) Rail Reactions

5) Project specific entrance shop drawings and details
6) Sill support detail
7) Project specific fixture shop drawings and details including car lanterns, hall pushbutton stations, car operating panel, etc.
8) Wiring diagrams
9) Insert diagrams
10) Project specific cab shop drawings and details including wall, ceiling, base, handrail, lighting, fixtures, front return and transom plans and sections

11) MRL criteria including:

a) Location of machine and governor
b) Structural requirements and reactions
c) Clearances
d) Access requirements

2. Calculations

a. Rail loads
b. Pit and machine room reactions
c. Heat emissions in machine room and hoistway.
d. Electrical loads, including accelerating and running currents. Include all auxiliary loads.
e. Rope Life Calculations utilizing the methodology developed by Dr Feyrer or other approved methods indicating that the selected machine's drive sheave and groove profile is properly matched to the ropes to provide the specified service life.

C. Keys

1. Upon the initial acceptance of work specified by the Contract Documents on each unit, the Contractor shall deliver to the Owner, four (4) keys for each general key-operated device that is provided under these specifications in accordance with ASME A17.1, Part 8 standards as may be adopted and modified by the AHJ.
2. All other keying of access or operation of equipment shall be provided in accordance with ASME A17.1 Part 8 as may be adopted and modified by the AHJ.

D. Diagnostic Tools

1. Prior to seeking final acceptance of the project, the Contractor shall deliver to the Owner any specialized tools required to perform diagnostic evaluations, adjustments, and/or programming changes on any microprocessor-based control equipment installed by the Contractor. All such tools shall become the property of the Owner.

a. The owner's diagnostic tools shall be configured to perform all levels of diagnostics, systems adjustment and software program changes which are available to the Contractor.
b. Owner's diagnostic tools that require periodic re-calibration and/or re-initiation shall be performed by the Contractor at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the project.
c. The Contractor shall provide a temporary replacement, at no additional cost to the Owner, during those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation or repair.

2. Contractor shall deliver to the Owner, printed instructions, access codes, passwords or other proprietary information necessary to interface with the microprocessor-control equipment.

E. Service Support Requirements

1. Software / Firmware Updates

a. During the life of the equipment and subject to the term of the maintenance agreement, where revisions to firmware and/or software are issued by the control manufacturer or manufacturer of solid state and microprocessor-based subsystems subsequent to the beneficial use of the equipment, updates shall be provided so that the installation and spare circuit boards are current with respect to software and firmware versions.

F. Wiring Diagrams, Operating Manuals and Maintenance Data

1. Deliver to the Owner two (2) identical volumes of printed information organized into neatly bound manuals prior to seeking final acceptance of the project.
2. The manuals shall also be submitted in electronic format on non-volatile media, incorporating raw 'CAD' and/or Acrobat 'PDF' file formats. Electronic manuals shall be properly indexed, bookmarked, and searchable.
3. Manuals, as well as electronic copies, shall contain the following:

    a. Step-by-step adjusting, programming and troubleshooting procedures that pertain to the solid-state microprocessor-control and motor drive equipment.
    b. Passwords or identification codes required to gain access to each software program in order to perform diagnostics or program changes.
    c. A composite listing of the individual settings chosen for variable software parameters stored in the software programs of both the motion and dispatch controllers.
    d. Method of control and operation.

4. Provide two (2) sets of "AS INSTALLED" straight-line wiring diagrams in both hard and electronic format in accordance with the following requirements:

    a. Displaying name and symbol of each relay, switch or other electrical component utilized including identification of each wiring terminal.
    b. Electrical circuits depicted shall include all those which are hard wired in both the machine room and hoistway.
    c. Supplemental wiring changes performed in the field shall be incorporated into the diagrams in order to accurately replicate the completed installation.

5. Furnish two (2) sets of bound instructions and recommendations for maintenance, with special reference to lubrication and lubricants along with the full Maintenance Control Program as required Part 8 of ASME A17.1.
6. Manuals or photographs showing controller replacement parts with part numbers listed.

G. Demonstration

1. Prior to seeking final acceptance of the project, the Contractor shall conduct a two (2) hour demonstration on-site with building personnel selected by the Owner.
2. The focus of the session shall include:

    a. Instructions on proper safety procedures and who to contact for the purpose of assisting passengers that may become entrapped inside an elevator car.
    b. Explain each control feature and its correct sequence of operation.

3. Control features covered shall include but not be limited to:

    a. Independent Service Operation.
    b. Emergency Fire Recall Operation - Phase I
    c. Emergency In-car Operation - Phase II.
    d. Emergency Power Operation.
    e. Emergency Communications Equipment.
    f. Security Operating Features.
    g. Interactive Systems Management.
    h. Emergency Hoistway Access and Rescue Features.

H. Patents

1. Patent licenses which may be required to perform work specified by the Contract Documents shall be obtained by the Contractor at its own expense.

2. The Contractor agrees to defend and save harmless the Owner, Consultant and agents, servants, and employees thereof from any liability resulting from the manufacture or use of any patented invention, process or article of appliance in performing work specified in the Contract Documents.

1.3 QUALITY ASSURANCE

A. Energy Conservation Code

1. The Contractor shall comply with the requirements set forth in the Energy Conservation Code as may be applicable to the AHJ.
2. Except for equipment or systems under the purview of other disciplines, elevator equipment provided by the Contractor requiring compliance shall include, but not be limited to:

   a. Energy efficiencies of gearless machines
   b. Absorption of regenerated power for elevators
   c. Energy efficiencies of car interior lighting and ventilation
   d. Automatic operation of car interior lighting and ventilation through the individual car controller

B. Qualifications

1. The work shall be performed by a company specialized in the business of manufacturing, installing and servicing conveying systems of the type and character required by these specifications with a minimum of ten (10) years of experience.
2. Prior written acceptance is required for manufacturers other than those listed, before quoting this project. Requests for acceptance will not be considered unless they are submitted before bid date and are accompanied by the following information:

   a. List of five (5) similar installations having exact equipment being proposed for this project arranged to show name of project, system description and date of completed installation. The list shall include the names, position and resumes of the construction team and field supervisor of the installations.
   b. Complete literature, performance and technical data describing the proposed equipment. Include the names, position and resumes of the proposed construction team and field supervisor.
   c. List of ten (10) service accounts by building name, building manager or owner, including phone numbers.
   d. Location of closest service office from which conveying system will be maintained.
   e. Location of closest parts inventory for this installation.
   f. List of the names, positions and resumes of the construction teams and field supervisor for the installation.

C. Structural, Mechanical and Electrical Design Parameters

1. The mechanical and electrical systems and the building structure have been designed for the following design loads:

   a. Structural Loads:

      1) The pit, machine space, and rail loads are shown in the drawings.

2.	Power supply:		208V-3PH-60HZ
3.	Electrical Loads:	PE1	20 HP 59 A. FLR (Full Load Running) 148 A. FLA (Full Load Acceleration)
4.	Heat Release:	PE1	9,000 BTU/HR

5. Submit a written statement with the bid that the above design loads and the clearance requirements shown on the Architectural drawings are acceptable for the proposed equipment. If not, specifically state the design variances.
6. After the award, if the type of equipment provided requires structure, mechanical and electrical system changes and/or revisions, the Elevator Contractor shall be responsible for all additional design and construction costs.
7. Electrical equipment, motors, controllers, etc., installed under this contract shall have the necessary CSA/US or UL listing as may be required by the AHJ. Equipment shall be labeled or tagged accordingly.

1.4 DELIVERY / STORAGE / HANDLING / COORDINATION

A. Delivery and Storage of Material and Tools

1. Delivery, Storage and Handling:

a. Deliver materials to the site ready for use in the accepted manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to accepted samples.
b. Store materials under cover in a dry and clean location, off the ground.
c. Remove delivered materials which are damaged or otherwise not suitable for installation from the job site and replace them with acceptable materials.

2. The Owner shall bear no responsibility for the materials, equipment or tools of the Contractor and shall not be liable for any loss thereof or damage thereto.
3. The Contractor shall confine storage of materials on the job site to the limits and locations designated by the Owner and shall not unnecessarily encumber the premises or overload any portion with materials to a greater extent than the structural design load of the Facility.

B. Work with Other Trades / Coordination

1. Coordinate installation of sleeves, block outs, equipment with integral anchors, and other items that are embedded in concrete or masonry for the applicable equipment. Furnish templates, sleeves, equipment with integral anchors, and installation instructions and deliver to the Project site in time for installation.
2. Coordinate sequence of installation with other work to avoid delaying the Work.
3. Coordinate locations and dimensions of other work relating to the equipment scheduled for installation including the pit ladder, sump in pit; entrance subsills; machine beams; and electrical service, electrical outlets, lights, and switches in the pit, machine space and control as it relates to the specific equipment.

C. Temporary Elevator (Elevator Contractor coordinate with General Contractor)

1. There may be a requirement for the use of an elevator during construction. Provide an alternate price for:

a. Temporary car enclosure.
b. Required guards and protective barriers.
c. Power and lighting.
d. Any special labor related to such temporary service.

2. The Contractor shall also include all charges connected with:

a. Testing of the unit for acceptance by the AHJ.
b. Maintenance required for temporary service.

3. All equipment shall be restored to a "like new" condition at the Contractor's expense prior to acceptance of the work by the Construction Manager.

1.5 WARRANTY / MAINTENANCE SERVICES

A. Contract Close-Out, Guarantee and Warranties

1. Guarantee and Warranties:

a. Warrant the equipment installed under these specifications against defects in material and quality of installation and correct any defects not due to ordinary wear and tear or improper use of car which may develop within one year from the date each unit is completed and placed in permanent operation and accepted by the Owner.
b. This warrantee shall be written and issued at the completion of each unit prior to final payment.

B. Maintenance

1. Interim Maintenance: Provide full protective maintenance on the units that are completed and accepted by the AHJ and that may be put in service prior to the overall project completion. The maintenance service shall be as hereinafter specified under the Full Protective Maintenance Service in "3" below and include all code mandated safety and local law tests and inspections that may come due while on this service.

a. The price quoted shall be on a per unit per month basis.

2. Warranty Maintenance: Provide full protective maintenance on the specified equipment for a period of twelve (12) months from the date of final acceptance of the entire installation as specified under the Full Protective Maintenance Service in "3" below.

a. The price for this service shall be included in the base price or as otherwise specified in the contract documents.

3. Full Protective Maintenance Service: Submit a separate price for a Full Protective Maintenance Service for the specified units based on a five (5) year contract. The price shall be submitted on the company's own form but shall include all requirements as specified hereinafter. Note: All maintenance shall comply with Part 8 of the ASME A17.1 Code and modified or amended by the Authority Having Jurisdiction.

a. Maintenance work shall be performed by certified/qualified personnel directly employed and supervised by the service contractor.
b. Perform scheduled maintenance work and repairs during the regular working hours of regular working days of the trade. All work shall be coordinated with the Building Manager.

4. Provide emergency callback service and repair twenty-four (24) hours a day, seven (7) days a week, including holidays, between regular examinations at no extra cost to the Owner. The response time during working hours shall not exceed one (1) hour. Perform emergency repairs within four (4) hours to restore the equipment to operating order. The following conditions will require emergency callback services for elevators:

a. Passenger entrapment.
b. Failure or malfunction of the control system.
c. Shutdown of the elevator.

5. Maintenance shall include monthly examination, adjustment, lubrication, repair or replacement of electrical and mechanical parts of all equipment and apparatus.
6. The maintenance services shall also cover re-lamping of machine room and pit lighting fixtures, signal and operating fixtures, communication system, cab ventilation system, monitoring and control panels. The disconnect means, fuses, car enclosures, car doors and hoistway entrances are excluded. Repair equipment whenever required and use only genuine standard parts produced and manufactured for the equipment concerned.

a. Include a minimum of two (2) hours of monthly labor for the specified scheduled preventive maintenance service.
b. The performance of mandated inspections and tests of the equipment, as required by the AHJ, shall be included in this agreement.

    1) Where required by the AHJ, witnessing shall be performed by a third-party licensed agency hired directly by the Owner.
    2) Where testing is required to be performed after normal business hours, Contractor shall invoice the after-hours work at the premium portion of the hourly billing rate only.

c. Provide firefighter tests and inspections as may be required.
d. One (1) month prior to the warranty expiration period, perform a Performance and Maintenance survey of all devices covered under the agreement and submit a report listing the recorded performance data, the emergency call-back services rendered during the year, and recommendations to further improve reliability and performance.

    1) When requested, provide a recording of each car's acceleration, deceleration and jerk rates along with a 3-day history of average corridor call wait times from 7 a.m. to 6 p.m. as recorded on a specified Tuesday, Wednesday and Thursday.
    2) Provide and document all required periodic testing.

e. During every scheduled maintenance visit, make sure the machine room and pit areas are clean.

    1) Paint the machine room floor and machine room equipment every three (3) years.

f. Adjust controls and maintain the equipment to meet the performance requirements as hereinafter specified.
g. If overtime repairs and maintenance services are requested and pre-approved by the Owner, the Contractor shall pay for the regular labor portion, and the Owner will cover the premium portion of the labor only.
h. Keep permanent records of inspections, maintenance services including lubrication procedures, emergency call-back services, repairs and replacements.
i. Maintain a complete set of updated wiring diagrams and schematic control diagrams in the machine room and provide the Owner with an additional record set.

7. Supply all necessary lubricants, cleaning materials and repair parts required to keep the system in good working order during maintenance periods.
8. Maintain an adequate stock of spare parts for maintenance or repair work and minor callback service repairs within the confines of the building in areas designated and assigned by the Owner. Maintain a catalog of spare parts available on site.
9. Additional parts of other equipment required for maintenance and repair of the systems may be stored at the Contractor's facilities with the understanding delivery of same for emergency procedures must be made within two (2) hours to the job site.
10. Other materials and equipment normally not stocked by the Trade Contractor locally must be available within twenty-four (24) hours for delivery to the job site from remote facilities and/or Supplier Contractors responsible to the Contractor for stocking the materials or equipment.
11. If the requirements for stockade of parts as defined herein are not met on any item, immediately notify the Owner in writing as to the circumstances and provide a confirmed delivery date for the required materials and equipment.
12. Should it become necessary to work on the equipment, proper safety barricades shall be erected to protect people from all hazards.
13. If for any reason (such as a strike), it is mutually agreed to temporarily reduce the level of maintenance, the monthly amount of the maintenance contract shall be reduced to reflect the reduction in maintenance services.
14. Should the Owner request that the maintenance Contractor perform any work on the equipment of this Contract, but not included in the terms of the Contract, then payment for such work shall be based on the rates included in the Contract for time and material.
15. Thirty (30) days before the annual renewal of this agreement, adjust monthly maintenance price as follows:

a. Eighty percent (80%) of the current maintenance price based on current straight-time hourly rate for a mechanic.
b. Twenty percent (20%) of the current maintenance price based on the established difference in the "Producer Commodity Prices for Wholesale Metals and Metal Products Index".
c. Notwithstanding anything to the contrary, the maximum annual increase shall not be more than three percent (3.0%) of the total contracted payment for the preceding contract year.

16. Cancellation: The Owner has the right to cancel this contract on 30 days' notice.
17. Obtain the following minimum insurance coverage:

a. Commercial General Liability Insurance on an Occurrence basis including:

1) Bodily Injury, Property Damage including Personal Injury and death.
2) "Per Project" endorsement.
3) Broad form property damage liability.
4) Blanket Contractual Liability including contractual liability assumed by this contract.
5) Independent Contractors Protective Liability coverage. The minimum limit for Comprehensive Liability insurance coverage shall be:

a) Each Occurrence: $1,000,000
General Aggregate: $2,000,000
including "Per Project"
endorsement Products &
Completed Operations Aggregate: $1,000,000
b) Excess liability limits of not less than:
Each Occurrence: $4,000,000
Coverage to follow form of underlying policies.

6) Worker's Compensation Insurance – In accordance with the statutory limits.
7) Employer's Liability Insurance – With a minimum limit of not less than:

a) Bodily Injury by Accident: $1,000,000 each accident
b) Bodily Injury by Disease: $1,000,000 each employee
c) Bodily Injury by Disease: $1,000,000 policy limit

8) Statutory State Disability Benefits Insurance covering all persons employed by the Contractor in connection with this contract.

b. The foregoing insurance policies shall be primary to any other insurance which may be carried by the Owner or Owner's Agent and shall name the Owner, the Owner's Agent and the Consultant as additional insured with a specific policy endorsement as follows:

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c. Certificates of Insurance evidencing such coverage shall be filed with the Owner's Agent prior to the commencement of the contract and all renewals of insurance certificates shall be furnished prior to the expiration of any coverage herein.

d. The policies shall contain a provision giving Owner and Owner's Agent thirty (30) days, or any longer period prescribed by North Carolina Insurance Law, prior written notice of any change or cancellation of such insurance, in the event of cancellation of Non-Payment of Premium, in which ten (10) day notice will be provided. This notice shall be included on the Certificate of Insurance.

e. All insurance must be with a licensed and admitted insurance carrier maintaining no less than an A.M. Best's rating of "A" or better, shall be size VII, and shall be subject to acceptance by Owner's Agent in its sole discretion.

f. The Contractor agrees that the required insurance is not intended to limit the Contractor's liability in the event that Contractor is deemed to be negligent in causing bodily injury or property damage during the course of its operation.

g. The Contractor shall, at its own expense, maintain physical damage insurance in the amounts and against the perils desired by the Contractor on all property of any kind owned or rented by the Contractor. The Contractor hereby waives its rights of recovery against the owner for any damage or loss to property of any kind which is owned or rented by the Contractor or for which the Contractor is liable.

h. The Purchaser/Owner may have the Contractor's work and systems' performance operation checked monthly to ensure the Contractor is performing in accordance with this Contract. If the work requirements are not maintained, the Purchaser/Owner will retain the monthly payment to the Contractor until the Consultant verifies that the work and/or operating performance is back to standard. If three (3) consecutive months of substandard maintenance is noted, the Owner has the right to immediately cancel the Contract without notice to the Contractor.

    1) The Consultant, Purchaser and/or Owner's Designee may withhold approval for payment on any request to such extent as may be necessary to protect the Owner from loss on account of:

        a) Negligence on the part of the Contractor to execute the work properly or failure to perform any provisions of the contract, The Owner, after three (3) days written notice to the Contractor, may, without prejudice to any other remedy make good such deficiencies and may deduct the cost of the contract.
        b) Claims filed or reasonable evidence indicating probable filing of claims due to the Contractor's failure to perform.
        c) Failure of Contractor to make payments properly to subcontractor for material and labor used to fulfill contractual requirements.
        d) Damage to the building as a result of work performed or another subcontractor's failure to perform.

i. Maintain the elevators to ensure there are no more than six (6) shutdowns per year. A shutdown will be classified as an elevator being out of service (for other than maintenance purposes) for more than four (4) hours. Note: If a car is out of service for twelve (12) hours, it will be recorded as three (3) shutdowns.

j. Unit shutdowns will be evaluated on a quarterly basis prior to payment. If the total number of shutdowns exceeds the annualized rate, there will be a $500 per shutdown deduction from the payment.

    1) If a unit is out of service for more than seventy-two (72) consecutive hours, except for a scheduled repair that exceeds this time limit, billing for that unit shall be suspended until the unit is placed in operation.

k. Contractor shall notify Purchaser and Consultant in writing regarding any necessary services, coverage or times which may have been omitted from the maintenance contract specifications and any irregularities, discrepancies or duplications that could affect the full comprehensive intent of the agreement.

1) Any duplication of work or coverage is specified as a means of demonstrating the contract requirements, but such duplication, if any, is not intended to expand coverage or increase requirements for such work or services and such duplication shall not increase costs or provide justification for extra or additional charge to the Purchaser.

1.6 ALTERNATES / ALLOWANCES / UNIT PRICES

A. Alternates

1. Value Engineering Alternate

a. It is understood that the base specification reflects minimum standards. The above Value Engineering Alternate allows individual contractors to suggest special performance criteria which may be of interest to the Owner and may reflect a degree of quality above the requirements of the base specification.
b. Voluntary alternate prices may be acceptable as a deviation from, not a substitution for, the basis of bid work of this bid package.
c. In order to submit a voluntary alternate, the following must be provided at the time of the bid.

1) A complete bid reflecting the requirements of the base specification.
2) All alternates must be accompanied with pertinent data, technical documentation and reference/installation for review.
3) Along with the pricing for voluntary alternates submit the maintenance prices for each.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

A. Elevator PE1

1.	Quantity	One (1)
2.	Type	Machine-room-less
3.	Loading Classification	Passenger – Class A loading
4.	Capacity (lbs.)	3,000#
5.	Speed (fpm)	200 fpm
6.	Travel in Feet	23’-1”
7.	Number of Landings	Three (3)
8.	Number of Openings	Three (3)
9.	Front Opening	Three (3) at Entry, 1, 2
10.	Rear Opening	None
11.	Operation	Simplex selective collective

12.	Control	Variable voltage variable frequency
13.	Fireman's Control	Phase I and II
14.	Number of Push Button Risers	One (1)
15.	Clear Inside Cab Dimensions	4'-8" wide x 6'-11 ½" deep
16.	Guide Rails	Steel tees
17.	Buffers	Spring
18.	Cab	As further specified
19.	Entrance Size	3'-6" wide x 7'-0" high
20.	Door Operation	Two speed side opening
21.	Machine Type	Gearless traction
22.	Machine Location	Within overhead space
23.	Controller Location	Remote 25'-0" at floor 2
24.	Counterweight Safety	Not Required
25.	Power Supply	208V-3PH-60HZ

2.2 MANUFACTURERS

A. Recommended Equipment Manufacturers

1. In addition to Original Equipment Manufacturers, the following manufacturer's equipment and materials are recommended for use on this project.
2. Other manufacturers/products not specifically mentioned below shall be considered for review on an individual basis upon submission of all design & maintenance submittal documentation conforming to the code and standards in effect as required by the AHJ.

    a. Controller - GAL (GALaxy)(Vantage), Motion Control Engineering (MCE), Elevator Controls Corporation, Elevator Systems, Inc., Smartrise, Schumacher, VMI, Claddagh
    b. Tracks, Hangers, Interlocks and Door Operators - G.A.L (Vantage), ECI, Wittur-Sematic
    c. Fixtures - G.A.L., Adams, EPCO, Monitor, E-Motive USA (Avire-Global), C.E. Electronics, Innovation, MAD, National, C.J. Anderson
    d. Door Protective Device - Janus, Adams, G.A.L., T.L. Jones, Tri-Tronics.
    e. Cabs and Entrances - CEC Elevator Cab, EDI/ECI, Elite Elevator Cab, Forms + Surfaces, National Cab & Door, Tyler, Velis, Gunderlin, Eklund, EMCO, Columbia Elevator Products, United Cabs, USC Elevator, H&B, G&R
    f. Machines - Hollister-Whitney (Vantage), Imperial, Torin, Wittur
    g. VVVF Power Drives - Mitsubishi, MagneTek, Yaskawa, TorqMax, KEB.
    h. VVVF Emergency Power Systems – MCE, Reynolds & Reynolds Electronics, ESI (TEERS).
    i. Guide Rails - Savera (AFD Industries), Monteferro, Harris Companies
    j. Electrical Traveling Cables – Draka, James Monroe, Wurtec, Datwyler, SEES
    k. Guide Shoes/Rollers – ELSCO, G.A.L, Wittur, Hollister Whitney (Vantage), Elpro, Delco
    l. Wire Ropes (Suspension means) - Paulsen, Bethlehem, Wayland, Draka, Gustav-Wolf, SEES, IPH
    m. Intercommunications/Telephones - Webb Electronics, K-Tec, Ring, Wurtec, Janus, approved equal.
    n. Car & Counterweight Frames and equipment – Hollister Whitney (Vantage), Wittur, Bore-Max, Global-Tardiff.

3. Original Equipment Manufacturers may substitute their own branded equipment subject to the following:

    a. All requirements of the specifications are met regarding performance, appearance, serviceability and support.
    b. A full stock of all regular and critical replacement parts required for this project is maintained at a facility within fifty (50) miles of the project site.

        1) Any parts not stocked at the above referenced facility shall be identified with the location of the nearest source and shall be available for next-day delivery upon demand.

    c. All parts and software shall be made available for purchase to a qualified elevator maintenance firm within one (1) business day delivery without direct Owner involvement.

        1) Provide details of parts supply facility and a list of current parts pricing for all major components required for the installation.

    d. All specialized tools, equipment, software, and passwords, required to maintain/update, repair, adjust the operation, and perform code mandated tests/inspections are provided to the Owner as part of the base installation.

        1) Updates to these items shall be available via the parts supply facility referenced above.

    e. Training and Technical support of the product(s) shall be available to the Owner's elevator service provider.

2.3 CONTROL FEATURES / OPERATION

A. Motion Control

1. Smooth stepless acceleration and deceleration of the elevator car shall be provided in either direction of travel during both single and multiple floor runs.
2. Use digital logic to calculate optimum acceleration and deceleration patterns during each run.
3. Acceleration, deceleration, jerk, maximum velocity, leveling accuracy and elapsed flight time, for a typical elevator one floor run, shall not exceed values as further specified.

B. Simplex Selective Collective Operation

1. Provide simplex selective collective operation from a riser of hall push button stations.
2. The registration of one or more car calls shall dispatch the car to the selected floors.

    a. The car shall also respond to registered hall calls in the same direction of travel.
    b. Car and hall calls shall be canceled when answered.

3. Stops in response to calls that are registered in either the car or hall push button stations shall occur in the natural order of progression in which the floors are encountered, depending on the direction of car travel, and irrespective of the order in which calls are registered.
4. When the car has responded to the highest or lowest call, and calls are registered for the opposite direction, the car shall reverse direction automatically and respond to those registered calls.
5. When the car arrives at its last stop and reverses the direction of travel, all previously registered car calls shall be automatically cancelled.
6. When the car arrives at a landing where both up and down hall calls are registered, it will answer the call in the direction of travel.

a. After a pre-determined delay, if no car call is registered, the car shall respond to calls registered in the opposite direction. Car doors shall close immediately, re-open and respond to the call for the opposite direction.
b. Hall lantern operation shall always correspond to direction of service.

7. When an empty car reverses direction at a landing with no hall calls, the doors shall not open and the hall lantern shall not operate.
8. If the car has no car calls registered and arrives at a floor where both up and down hall calls have been registered, the car shall respond to the hall call corresponding to the last direction of car travel. If, after making its stop, a car call is not registered and no other hall calls exist ahead of the car corresponding to its original direction of travel, the doors shall close and immediately reopen in response to the hall call for the opposite direction.
9. The car shall maintain its original direction at each stop until the doors are fully closed to permit a passenger to register a car call before the car reverses its direction of travel.

C. Independent Service Operation

1. The car operating station shall be equipped with a key-operated switch labeled “IND SER”.
2. Locate the switch in the locked service compartment.
3. When placed in the “on” position the following shall occur:

a. Simplex elevator - existing hall call registrations shall extinguish and hall buttons shall remain inoperative as an indication to passengers that there is no elevator service.

4. During Independent Service Operation, the elevator doors shall remain open at any landing until the door closes or a car call push button is pressed and maintained until the doors are fully closed.
5. If more than one (1) car call is registered, all registered car calls shall extinguish when the elevator stops in response to the first call.
6. Fire Emergency Recall shall automatically override Independent Service Operation and engage Phase I - Fire Emergency Recall Operation following a period of approximately forty-five (45) seconds.

D. Inspection Service Operation

1. Provide a key operated switch in the main car operating panel locked service panel that, when turned to the ‘ON’ position, shall cause the elevator to be removed from service and placed in Inspection Service Operation.
2. Limited operation of the car shall be provided through pressing the Attendant Service up and down push buttons (if provided) or the highest or lowest car call push buttons (if up and down buttons are not provided) in the main car operating panel only.
3. The car shall move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with both the hall and car door panels in the closed and locked position.
4. The Inspection Service switch shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
5. The top of the elevator car shall be equipped with a control for limited operation of the car during repairs, maintenance and inspection conducted in the hoistway. The transfer of control to the top of car operating device shall cause that device to be the sole means of control for the elevator.

a. Visual and audible indication shall be provided on the top of the car when Firefighters’ Emergency Operation is initiated.

6. Power door operating equipment shall be rendered inoperative while the car is being operated in the Inspection Service mode with the exception of power closing of the door. The control system shall maintain closing power on the door while the elevator is moving under Inspection Service Operation.
7. The in-car Inspection Service switch shall be rendered ineffective when the top of car inspection control is activated.
8. Machine Room Inspection Operation and Inspection Operation with open door circuits shall be provided in accordance with A17.1 Safety Code, as modified and adopted, where required or allowed by the AHJ.

E. Hoistway Access Operation

1. Provisions shall be made to allow access to the hoistway through the use of hoistway access switches.
2. Operating the access switch shall permit the car to move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with the hall and car doors in the open position to obtain access to the top of the car or climb-in pit.
3. The car shall automatically stop motion when the car top is level with the hoistway door sill for access to top of car.
4. The access key switch(es) shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
5. Access operation shall be disabled when top of car inspection operation is in effect.

F. Load Weighing Operation

1. A positive means shall be provided to continuously monitor the amount of load being transported by the elevator car.
2. The system shall be used to:

    a. Preload static motor drives.
    b. Activate control features that include:

        1) anti-nuisance operation.
        2) load dispatch operation.
        3) load dependent non-stop operation where applicable.

3. The anti-nuisance feature shall operate at loads not exceeding 200 lbs., whereas load dispatch and load non-stop shall be set to function at 65% of the rated loading capacity for the initial set up and adjustment procedure.

G. Firefighters' Emergency Operation / National

1. Phase I Emergency Recall Operation shall be provided for each car in accordance with ASME A17.1 code as modified under the applicable local or State law.
2. Each main or auxiliary car operating station shall be provided with an indicator light and warning buzzer, each of which shall become activated whenever Phase I Operation is engaged.

    a. The warning buzzer shall cease to function once the car has completed the recall sequence and is positioned at the designated recall landing.
    b. The indicator light shall remain illuminated as long as Phase I Operation is activated.

3. A three-position, key-operated switch shall be provided on the designated recall landing to manually activate Phase I Operation.

    a. When activated, Phase I Operation shall be arranged so that in order to reset normal service, all cars must first be returned to the designated recall landing, after which the Phase I key-switch must be turned to the "OFF" position.

4. A standardized Fire Recall Key shall be used where required by the codes and standards applicable to the AHJ.
5. Phase II Emergency Recall In-Car Operation shall be provided for each car in accordance with ASME A17.1 code as modified under local or State law.
6. Locate controls required for Phase II In-Car Operation in a locked access cabinet in the main car operating panel.

    a. The cover of the locked access panel shall be engraved as required by local or State law.
    b. The locked access panel shall contain:

        1) Phase II key switch.
        2) Fire indicator light.

3) Call cancel push button.
4) Door open push button.
5) Door close push button.
6) Run/Stop switch.
7) Other devices that may be required by local law.

c. Engrave the Firefighters' Service operating Instructions on the inside of the locked cabinet door.

H. Flood Zone Requirements / Flood Operation

1. The elevator shall be provided with additional flood resistance measures in compliance with the Building Code North Carolina.

a. Provide a water sensor located below the lowest electronic protective device within the pit which shall transmit a signal to the elevator control to initiate "flood operation".
b. Upon activation of "flood operation":

1) The car shall be parked at the first stop above flood level, or at an alternate location as directed by the AHJ.
2) The automatic lowering device shall not lower the car below the flood level when "flood operation" is active.

c. Provide a visual signal at the lobby hall station and in the car operating panel to notify passengers and emergency responders that the car is in "Flood Operation".
d. Provide additional control measures as required by local codes.
e. "Flood Operation" functions and designs are subject to approval and / or revision by the AHJ. The Elevator Contractor shall verify "Flood Operation" functions with the AHJ prior to equipment installation.

I. Floor Lockout Feature / Keyless - Card Reader Control / Wiring Provisions

1. Wiring: Provide six (6) pair of 20 gauge two (2) flexible conductor low voltage cables with an overall braided shield in the traveling cable of all elevators for card reader interface.

a. The cables shall extend from the security interface terminal cabinet in the elevator machine room to behind the elevator return panel above the space allotted for the card reader.
b. Terminate the cable to dual screw barrier terminal strips on each end.

2. Card Reader Space: Allocate card reader space in the car station as directed by the Architect. Provide a flush Lexan lens and mounting provisions for the card reader unit which is provided by others.
3. Interface: For floor programmable card access control in all elevators, provide a pair of terminals for all floors such that application of a momentary dry (no voltage present) contact closure across those terminals by the security system shall enable the selection of the corresponding floor from the floor selector button in the elevator cab.

a. Locate the terminals inside an interface terminal cabinet in the elevator machine room.
b. Provide all relays required to interface the elevator control system to the momentary dry contact closures provided for under another section of these specifications.
c. If applicable, the card reader shall be operable and compatible with the issued card keys used building wide.
d. Coordinate system requirements with the manufacturer of the issued card key system.

4. Card Reader "Secure/Bypass" Switch: Provide separate card reader control bypass key switches for each elevator.

a. The bypass key switches shall be located in the car station service cabinet.
b. The bypass key switches shall be a maintained contact type key switch with the key removable in the secure or bypass position.

1) When the key switch is in the secure position, the card reader control mode shall be initiated.
2) When in the bypass position, the card reader control mode shall be bypassed and the elevator shall return to normal operation, permitting free access to any floor.

5. The card reader operation shall bypass floor cut-out switches.
6. Firefighters' Service Operation shall override Floor Lockout Feature.

J. Elevator Security Interface Requirements

1. Card Reader and Remote Control of Elevators via Hall Call Button

a. The hall call buttons for the elevator shall be card reader controlled on all floors.
b. When the hall call button is in the card reader-controlled mode of operation, the elevator user shall be required to hold an access card up to a card reader within the hall call station to enable activation of the hall call button. The card reader shall be an integral part of each hall pushbutton station. Flush Lexan lens and mounting provisions shall be provided by the elevator contractor. The card reader unit and wiring back to the card reader interface panel shall be provided by others.

1) The acknowledging light shall illuminate the time of authorized activating until the elevator arrives.

c. The security system shall provide for card reader control of the elevator hall call button on a time programmable basis.
d. To provide for card reader control of the elevator hall call button, provide a pair of terminals such that the application of a dry contact closure across those terminals by the security system shall enable the activation of the hall call button.
e. When the hall call station is in the card reader-controlled mode, the security system shall place a closure across the contacts for five (5) seconds upon reading a valid card to allow for activation of the button.
f. When the hall call station is in the non-reader-controlled mode, the security system shall maintain a closure across the contacts allowing the hall call button to be selected without an access card.

2. The remote call function shall be controlled by the security system through the same terminals provided for card reader control

K. Passenger Rescue Feature

1. Provide a device in the control room to move the elevator car to a floor landing in the event of controller or power failure.

a. This device must be speed controlled to prevent an overspeed condition.
b. A line of sight must be provided between the Passenger Rescue Feature device and the elevator car.

1) Coordinate line of sight requirements with the control room requirements.

2. Provide a manual brake release lever attached to the control cabinet for rescue of passengers.

a. A visual display shall be provided with the control cabinet, which indicates car position, speed and directions.

L. Door Operation

1. Car and hoistway doors shall be arranged to operate in unison without excessive noise or slamming in either direction of travel.

a. Door opening speeds of two (2) feet per second shall be provided in conjunction with closing speeds of 1.0 foot per second in accordance with the governing code.
b. Door operation shall commence as the car stops level at the floor and the machine brake is applied. Pre-door opening shall not be permitted.

2. Where the hoistway door and the car door are mechanically coupled, the kinetic energy of the closing door system shall be based upon the sum of the hoistway and the car door weights, as well as all parts rigidly connected thereto, including the rotational inertia effects of the door operator and the connecting transmission to the door panels.
3. The force necessary to prevent closing of the car and hoistway door from rest shall not exceed thirty (30) lbf. This force shall be measured on the leading edge of the door with the door at any point between one-third and two-thirds of its travel.
4. The door open and door close time shall be measured between the moment car door operation in either direction begins and the instant at which that cycle is completed.
5. When responding to either a car or corridor call, the amount of time that the elevator door remains stationary in the open position shall be adjustable up to sixty (60) seconds.

    a. Door open dwell time for a corridor call shall be separate of that for a car call, and in both cases, dwell time shall be canceled whenever the car door protection device is momentarily interrupted by passenger transfers, followed by a reduced door open dwell time of approximately one (1) second (adjustable) after the door protection device is cleared of obstructions.

6. The operation of the door protective device by interruption of one or more infrared light beams (dual or multi-beam non-contact) during the close cycle shall cause the immediate reversing of the doors to the fully open position.
7. The door closing cycle shall be arranged so that, in the event the door protective devices become continually obstructed after the normal door open dwell time has expired, and following a time interval of approximately thirty (30) seconds (adjustable), a warning tone shall sound and the door closing cycle shall commence at reduced speed and torque per applicable Code requirements.
8. Each car operating station shall be provided with a “door open” and “door close” push button.

    a. Pressure on the “door open” button shall cause doors in the full open position to remain so and doors engaged in the close cycle to reverse direction and assume the full open position so long as pressure remains applied to the button.
    b. The “door open” buttons shall also control the open cycle during Phase II - Emergency In-car Operation.
    c. The “door close” push button shall function on Independent Service, Attendant Service and Phase II - Emergency In-car Operation as well as during normal automatic operations.

9. Repeated attempts by the power door operator to open or close the door at any landing shall be monitored by the control system.

    a. In the event the door fails to cycle properly after a preset (adjustable) number of attempts, the car shall either travel to the next stop or remove itself from service, depending upon whether the malfunction is in the open or close cycle.

10. Each hoistway door shall be provided with an automatic self-closing mechanism arranged so that the door shall close and lock if the car should leave the landing while the hoistway door is unlocked.
11. Car doors shall be arranged to prevent their being manually opened from inside the car unless the elevator is positioned within a floor landing zone.

2.4 CONTROL ROOM / MACHINE SPACE EQUIPMENT

A. Controller

1. The elevator shall have a generic microprocessor-based controller.

2. Digital logic shall calculate optimum acceleration, deceleration, and velocity patterns for the car to follow during each run.
3. Closed-loop distance and velocity feedback shall monitor the actual performance of the elevator car with the desired speed profile.
4. System operating software shall be stored in non-volatile memory.
5. Elevator control relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, electronic circuit boards, microprocessors, static motor drive units, wiring terminal blocks and related components shall be totally enclosed inside a free-standing metal cabinet with hinged access doors.

    a. Provide natural or mechanical ventilation for the controller cabinets.
    b. Equip the vent openings and exhaust fans with filters.

6. Mount equipment to moisture-resistant, noncombustible panels supported from the steel frame.
7. Provide a “noise filter" between hoistway wiring and controller/dispatchers to eliminate interference.
8. Optically isolate communication cables between components.
9. Wiring: Wiring on the units, whether factory or field wiring, shall be done in neat order, and all connections shall be made to studs and/or terminals by means of grommets, solderless lugs or similar connections. All wiring shall be copper.
10. Terminal Blocks: Provide terminal blocks with identifying studs on units for connection of board wiring and external wiring.
11. Marking: Identifying symbols or letters shall be permanently marked on or adjacent to each device on the unit, and the marking shall be identical with marking used on the wiring diagrams. In addition to the identifying marks, the ampere rating shall be marked adjacent to all fuse holders.
12. The manufacturer’s standard on-board “LCD” display shall be incorporated on the main processor board and/or otherwise incorporated in the controller cabinet. The “LCD” shall be capable of providing alpha-numeric characters to view the operational status of the elevator and/or group functions depending on the application. The display shall provide the user with necessary information for troubleshooting and reprogramming of the basic system parameters.

    a. Where the “LCD” is not an integral part of the controller and troubleshooting/reprogramming requires the use of a separate tool, the tool shall be maintained in the machine room and accessible to service personnel. This tool, along with all technical documentation for the correct use of the tool, shall remain the property of the Owner.
    b. Password protection of critical programming features is required to prevent accidental changes to life-safety and other non-typical control settings.
    c. Where a separate dispatch or group control panel is provided, a separate “LCD” display shall be provided to view group functions.

13. In the event diagnostics and monitoring is accomplished via Field Service Tools, provide the required Field Service Tools with related control system appurtenances for diagnostic evaluations, system monitoring and field adjustments.

    a. Provide instructions for proper use of such diagnostic tools and/or equipment with all coding and other operational requirements.
    b. Maintain and calibrate the diagnostic tools and update the associated instructions and other related documents under the service agreement.

        1) Should the agreement be cancelled for any reason by either party, maintenance and updating of diagnostic tools shall be provided to the Owner at the Contractor's cost without the need to purchase or lease additional diagnostic devices, special tools or instructions from the original equipment provider.
        2) The Owner may request field and technical instructions be provided by the original installation contractor or manufacturer for proper servicing by other qualified elevator company personnel.
        3) The established cost-plus profit, as previously specified, shall be applicable for the life of the system.

a) If the equipment for fault diagnosis is not completely self-contained within the controllers but requires a separate detachable device, that device shall be furnished to the Owner as part of this installation.
b) Such device shall be in possession of and become property of the Owner.

14. Microprocessor Documentation

a. Provide and/or obtain complete information on systems' design, component parts, installation and/or modification procedures, adjusting procedures and associated computer conceptual logic circuitry and field connection.
b. Provide microprocessor upgrading and/or modifications to programs that have been assigned to enhance the operation of the equipment for a period of ten (10) years after project approval.

B. Machine Beams

1. Provide machine beams, angles, plates, rails, bearing plates, blocking steel members to support the machine, governor, and dead-end hitches. The machinery and dead-end hitches shall be located within the hoistway as shown in the drawings. Coordinate attachments of the machine beams to the building structure and required beam pockets with the Structural Engineer.
2. Provide fixed 2:1 sheave(s) at the top or bottom of the car frame and on top of the counterweight frame
3. Locate the hoist machine in a manner to eliminate any interference with the hoistway walls and to provide proper clearances around the equipment.
4. The mounting of the hoist machine shall incorporate isolation to minimize the transmission of noise and/or vibration to the building structure.

C. Gearless Elevator Hoisting Machine - MRL

1. Provide a permanent magnet synchronous motor (PMSM) gearless traction machine, specially designed and manufactured for elevator service. The machine shall have high starting torque and low starting current, rated for 50^0 C (90^0 F) continuous operation, and a minimum of 210 starts per hour.

a. Securely mount the machine to overhead steel beams or to the guide rail system.
b. The armature shaft shall be supported in ball or roller type bearings.
c. The driving sheave shall be cast from the best grade of metal with a Brinell hardness of 215 to 230 and shall be machined with grooves, providing maximum traction with a minimum of rope and sheave wear.
d. Ensure that adequate ventilation of internal stator windings and rotating element is provided to prevent overheating with thermal overload protection. (Constant velocity fan for constant cooling.)
e. Equip housing with eyebolt(s) for lifting.
f. Provide the machine with an electro-mechanical brake.

1) The brake shall be spring applied and electrically released where drum or disk-type brakes are employed.
2) Design the brake electro-magnet for quick release and application of the brake.
3) The brake lining material shall be non-asbestos.

g. Design the brake for quick release to provide smooth and gradual application of the brake shoes.

1) An emergency brake shall be an integral part of the machine design.

h. Provide a sheave guard and rope retainer on the machine sheave to prevent hoisting rope from jumping off the grooves.

1) Provide service platforms, grating, handrails, ladders and required accessories to service and maintain the hoisting machines, if required by the local AHJ.

i. Design and construct the hoisting machine based on passenger elevator cab enclosure weight as specified and as shown on the architectural drawings.

D. VVVF AC Drive

1. Provide a solid-state, variable voltage, variable frequency (VVVF), 3-phase AC hoist motor drive system as part of the microprocessor-based equipment.

    a. VVVF drive system shall be a low-noise, flux-vector inverter device.
    b. Include a digital LED readout and touch-key pad to facilitate software parameter adjustments, monitor system operation and display fault codes.

2. The drive shall utilize a 3-phase, full wave rectifier and capacitor bank to provide direct current power for solid-state inversion.
3. The inverter shall utilize IGBT power semiconductors and duty cycle modulation fundamental frequency of not less than one kilohertz to synthesize 3-phase, variable voltage variable frequency output.
4. The system shall be designed and configured with the following countermeasures for noise generated by the pulse-width modulated (PWM) inverters.

    a. Control of radiated noise via inverter and/or motor cables.
    b. Conducted noise through power lines.
    c. Induction noise and ground noise.

5. Inverter shall be encased in metal and independently grounded.
6. A noise filter for the input power line shall be provided to prevent penetration into radios, wireless equipment and smoke detectors.
7. A 3% three-phase line reactor shall be provided on the power system rated at the utility voltage input to the drive and sized for the rated drive current.
8. The drive shall:

    a. Be configured as a complete digital drive system.
    b. Be totally software configurable.
    c. Interface with external equipment/signals via either discrete local I/O connections or high-speed Local Area Network (LAN).
    d. Be located within the limits of the control cabinet (where system size allows) or separately mounted in an appropriate chassis with hinged swing-out doors with clearances equal to the cabinet width dimensions.
    e. Provide programmable linear or S-curve acceleration.
    f. Provide free run or programmable linear or S-curve deceleration.
    g. Have controlled reversing.

9. Operating and Environmental Conditions:

    a. Have a service factor of 1.0.
    b. Rated for continuous duty.
    c. Humidity - 90% rated humidity non-condensing.
    d. Cooling - forced air when required.
    e. Digital display for:

        1) Running - output frequency, motor RPM, output current, voltage.
        2) Setting - Parameters values for setup and review.
        3) Trip - separate message for each trip, last thirty (30) trips to be retained in memory.

10. Protective Features:

    a. Motor overspeed.
    b. Adjustable current limit.
    c. Isolated control circuitry.
    d. Digital display for faulty conditions.
    e. Selectable automatic restart at momentary power loss.
    f. Manual restart.
    g. Over/Under Voltage.
    h. Line to line and line to ground faults.
    i. Over-temperature.

E. VVVF AC Drive - Regenerative Module

1. The system shall provide full regenerative capabilities to control overhauling motor speed and reduce hoist motor deceleration time by allowing overhaul power to be discharged back into the power lines.
2. The regenerative section may be an integral part of the drive, or a stand-alone unit mounted in a separate cabinet with proper ventilation as required by the manufacturer.

F. VVVF Emergency Return / Auxiliary Power System

1. Provide a system that will make back-up power available to the elevator when commercial power fails.
2. The unit shall safely move the elevator to the lobby landing and provide power to the door operator to allow passengers to exit.
3. The movement of the car may be loading dependent utilizing dynamic braking to control car speed.
4. The unit shall include:

    a. On board controller.
    b. UPS status monitor capable of notifying building management system.
    c. Restart input from the car door open button.
    d. Test button to simulate power failure.
    e. UPS bypass control.
    f. Monitoring of the disconnect switch.
    g. Lockable shut-off switch.
    h. Three phase, 208/460 VAC input.
    i. Battery level LED indicator.
    j. Necessary fusing for batteries, outputs, logic circuitry and charger.

G. Overspeed Governor

1. Provide a speed governor, located overhead, to operate the car safety.

    a. Maintain the proper tension in the governor rope with a weighted tension sheave located in the pit.

        1) Springs used to develop the tension are not acceptable.

    b. Provide rope grip jaws, designed to clamp the governor rope to actuate the car safety upon a predetermined overspeed downward.

        1) The centrifugal type of governor shall trip and set rope jaws within 60 degrees of governor sheave rotation after reaching rated tripping speed.

    c. Design the governor rope tripping device so that no appreciable damage to or deformation of the governor rope shall result from the stopping action of the device in operating the car safety.

d. Provide an electrical governor overspeed protective device which shall remove power from the driving machine motor and brake before or at the application of the safety.

1) The setting for the overspeed switch shall be as prescribed in the ASME A17.1 Safety Code.
2) Locate and enclose the switch to ensure that excess lubrication will not enter the switch enclosure.
3) Overspeed switch shall operate in both directions of travel on systems employing a static power drive unit.

e. Seal and tag the governor with the running speed, tripping speed and date last tested.
f. Design the governor to prevent false tripping due to conditions caused by rope dynamics.
g. The governor shall be mounted to the guide rail system or machine beam supports in the hoistway overhead.

1) Coordinate access requirements and testing procedures with the AHJ.
2) Where governor access is not required by the AHJ, governor shall be capable of being manually reset from outside the hoistway.

H. Equipment Isolation

1. Provide effective sound isolation between the machine, solid state motor drive unit and filter, from building structure to reduce noise transmission to occupied spaces and elevators and elevator cabs.
2. When operating per plans and specifications, the elevator equipment shall not generate noise levels in excess of NC-40 in occupied tenant spaces and shall be free of pure tones. For the purposes of this specification, a pure tone shall be defined as a sound level in any one-third octave band which is greater than 5 dB above both adjacent one-third octave bands, in the range 45 to 11,200 Hz.
3. Provide the following as a minimum:

a. Isolate the transformers and reactance units from the building structure by means of approved neoprene-in-shear isolators having a minimum static deflection of 3/8".
b. Solid state rectification units shall be mounted on 3/4" thick minimum, neoprene-in-shear pad isolators and an effective electrical filter/reactance limiting electrical noise shall be provided.
c. Use flexible conduit with ground wire for motor, machine, drive, governor and position/velocity transducer connections.

I. Emergency Brake

1. Ascending Car Overspeed Protection Device

a. Provide a device designed to prevent an ascending elevator from striking the hoistway overhead structure.
b. The device shall decelerate the car with any load up to the rated capacity by applying an emergency brake.

1) The device shall detect an ascending car overspeed condition of not greater than 10% higher than the speed that the car governor is set to trip.
2) The device, when activated, shall prevent operation of the car until the device is manually reset.
3) The device shall meet the requirements of the ASME A17.1 Safety Code as may be modified by the AHJ.

2. Unintended Car Movement Protection Device

a. Provide a device to prevent unintended car movement away from the landing when the car and hoistway doors are not closed and locked.

1) The device shall prevent such movement in the event of failure of:

a) The electric driving machine motor.
b) The brake.

c) The machine shaft or shaft coupling.
d) Machine gearing.
e) Control system.
f) Any component upon which the speed of the car depends.
g) Suspension ropes and the drive sheave of the traction machine are excluded.

2) The device shall prevent operation of the car until the device is manually reset.
3) The device shall meet the requirements of the ASME A17.1 Safety Code as may be modified by the AHJ.

2.5 HOISTWAY EQUIPMENT

A. Guide Rails / Inserts / Brackets

1. Provide machined, standard size steel "T" section guide rails with tongue and grooved joints for the car and counterweight. Use not less than 15.0-pound car rails. Size rails to span maximum vertical distance between supports as noted on the drawings.
2. The car guide rails shall be as follows:

   a. Savera Super Line, Monteferro S or approved equal.

3. Use not less than 3/4" thick machined steel fishplates to form rail joints. Connect rails to fishplate with four (4) bolts.
4. For the concrete hoistway, furnish rail brackets and provide inserts and an insert location drawing to Construction Manager or General Contractor.
5. Brackets shall be used to support the rails from the hoistway inserts.

   a. The rails shall be attached to the brackets by heavy clamps or clips.
   b. Bolting or welding rails to brackets shall only be allowed in certain instances.

6. All guide rails shall be erected plumb and parallel to a maximum deviation of 1/8 inch (plus or minus 1/16 inch).
7. Provide oversized steel members and brackets for the rails where the distances exceed the manufacturer's standard dimensions.

B. Counterweight Assembly / Frame

1. Counterweight shall consist of a steel frame welded or bolted together and necessary steel sub-weights.

   a. Sub-weights shall be held within the frame by not less than two (2) tie-rods passing through holes in all weights with rods equipped with locknuts, secured by washers and cotter pins at each end.
   b. The counterweight shall be equal to the weight of the elevator car and approximately 40% of the contract (specified) capacity.
   c. Provide the required pit counterweight guard where no compensation is used.
   d. The bottom of the counterweight shall have a buffer striking plate and means to attach knock-off blocks to compensate for varying rope length.

C. Roller Guides

1. Provide roller guide shoes with adjustable mounting base, rigidly bolted to the top and bottom of each side of the car and counterweight frame.

   a. Roller guides shall consist of a set of sound reducing neoprene wheels in precision bearings held in contact with the three (3) finished rail surfaces by adjustable stabilizing springs.
   b. The bearings shall be sealed or provided with grease fittings for lubrication.
   c. Equip roller guides with adjustable stops to control post wise float.

d. Fit the top car roller guides with galvanized, painted or powder coated steel guards.

2. Approved applications and manufacturers:

a. ELSCO Model B for car roller guides and ELSCO Model D for counterweight guides or approved equal.

D. Hoist Ropes

1. Pre-formed traction steel wire rope, specifically constructed for elevator applications, shall be provided for suspension of the elevator car and counterweight assembly.

a. Fastening shall be accomplished by the use of individual tapered rope sockets (wedge clamp) with adjustable shackles.
b. Shackles shall be installed in accordance with the manufacturer's requirements to eliminate noise and bounce under normal operation.
c. Install maple blocks or other approved spreader assembly to manage rope transition from hitch arrangement to sheave arrangement.
d. General design requirements for rope shackles and the method of securing wire rope shall conform with ASME A17.1 elevator safety code as modified by, and/or in addition to codes and standards accepted by the AHJ.
e. Provide machine-room-less elevators with hoist ropes having steel core.
f. Properly select rope for the application and compatibility with the machine drive sheave hardness and groove profile. Design shall provide for a minimum service life of One-million cycles or 10 years, whichever comes first, and shall be substantiated by calculations during the submittal phase.

2. Provide anti-spinout as required by applicable code at all shackles where applicable.
3. Coated steel belts with steel cords embedded in polyurethane case may be used in lieu of conventional steel hoist ropes subject to approval of the AHJ.

a. Belts shall be UL listed and non-combustible.

E. Governor Rope

1. Pre-formed wire rope specifically constructed for elevator applications, shall be provided for governor ropes.

a. Rope shall be traction steel or iron in accordance with OEM design requirements.
b. Rope diameter and method of fastening shall be in accordance with ASME A17.1 Safety Code as adopted and/or otherwise modified by the AHJ.

F. Electrical Conduit / Wiring / Traveling Cable

1. Electrical wiring shall be provided.

a. All wiring shall be stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
b. Electrical wiring provided for hoistway interlock shall be of a flame-retardant type, capable of withstanding temperatures of at least 392 degrees Fahrenheit. Conductors shall be Type SF or equivalent.
c. Each run of electrical conduit or duct shall contain no less than 10% spare wires and, in any case, no fewer than two (2) spare wires.
d. Crimp-on type wire terminals shall be used where possible.

2. A travel cable(s) shall be provided.

a. Each traveling cable shall be provided with a flame- and water-resistant polyvinyl chloride jacket.

b. Electrical wiring shall consist of stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
c. Each travel cable shall contain no less than 10% spare wires.
d. Traveling cable exceeding 100' in length shall be provided with a steel wire rope support strand from which the cable shall be suspended.
e. Traveling cable must be contained within an approved electrical conduit to within 6' of the final suspension point in the hoistway.
f. Each traveling cable shall be arranged to provide no fewer than six (6) individually shielded pairs of 20-gauge wire and arranged to contain no less than one (1) coaxial cable for CCTV remote monitoring.
g. Traveling cable conductors that terminate at a hoistway center box shall be connected to stud blocks provided for that purpose.

1) Each wiring terminal shall be clearly identified by its nomenclature as shown on the "as built" wiring diagrams and solderless, crimp-on type wire terminals shall be used where possible.

h. The attachment of a traveling cable to the underside of the elevator car shall be performed so that a minimum loop diameter of 30x the cable diameter is provided.
i. Pre-hang the cables for at least twenty-four (24) hours with ends suitably weighted to eliminate twisting during operation.

3. Rigidly supported EMT conduit, flexible metal conduit and galvanized steel trough shall be utilized throughout the hoistway.

a. Both EMT and flexible conduit shall be connected on either end by use of compression fittings and secured in place with metal clamps sized in accordance with the diameter of conduit utilized.

1) Wire or plastic wire ty-raps shall not constitute an acceptable means of fastening.

b. The use of flexible metal conduit shall be limited to runs not greater than three feet (3') in length.

G. Normal and Final Terminal Stopping Devices

1. Provide normal terminal stopping devices to stop the car automatically from any speed obtained under normal operation within the top and bottom overtravel, independent of the operating devices, final terminal stopping device and the buffers.
2. Provide final terminal stopping devices to stop the car and counterweight automatically from the speed specified within the top clearance and bottom overtravel.
3. The terminal stopping devices shall have rollers with rubber or other approved composition tread to provide silent operation when actuated by the cam fixed to the top of the car.

a. Terminal stopping devices that are not mechanically operated (i.e.: magnetic proximity) shall be provided by the manufacturer of the control equipment, intended for use as a terminal limit, and designed for reliable operation in the hoistway environment.

4. Final terminal limits shall be pinned so as to prevent movement after final adjustment where required by the AHJ.

H. Emergency Terminal Speed Limiting Device

1. Provide necessary emergency terminal speed limiting devices where reduced stoke buffers are used.

a. Operation of the device shall be independent of the operation of the normal terminal stopping device.

b. Arrange the device to automatically reduce the car and counterweight speed by removing power from the driving machine motor and brake so that the rated striking speed of the buffer is not exceeded at the time of impact.
c. The sensing device shall be independent of the normal speed control system.
d. Short circuits caused by grounds or other conditions shall not prevent the operation of the device.

2.6 PIT EQUIPMENT

A. Car and Counterweight Buffers

1. Provide buffer with necessary blocking and horizontal steel braces under the car and counterweight.
2. Provide spring type buffers for elevators with operating speeds of up to and including 200 fpm.
3. Use reduced stroke buffer with associated terminal slowdown devices where runby is restrictive.

a. Buffer and emergency terminal slowdown device shall operate in accordance with applicable codes.

4. The buffer shall be tested and approved by a qualified testing laboratory.
5. Provide a permanent buffer marking plate which indicates the manufacturer's name, identification number, rated impact speed and stroke.
6. Provide a permanent data plate in the vicinity of the counterweight buffer indicating the maximum designed counterweight runby.
7. Support buffers from the pit floor level with all required pit channel, blocking, and bracing steel members.

B. Governor Rope Tension Assembly

1. Provide a governor rope tension assembly.

a. Maintain the proper tension in the governor rope with a weighted tension sheave located in the pit.

1) Springs used to develop the tension are not acceptable.

b. The sheave shall be of proper diameter and set directly plumb with the governor rope drop to prevent the rope from pulling off of the sheave at an angle.
c. Lubrication fittings shall be provided at the assembly.
d. The assembly shall have necessary rope guards to prevent accidental contact of the rope/sheave by service personnel and to prevent the governor rope from jumping off the sheave.

C. Pit Stop Switch

1. Where pit depth does not exceed 67”, each elevator pit shall be provided with a push/pull or toggle switch that is conspicuously designated “EMERGENCY STOP” and located so as to be readily accessible from the hoistway entrance on the lowest landing served at a height of approximately 18” above the floor.

a. This switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the “OFF” position.

2.7 HOISTWAY ENTRANCES

A. Hoistway Entrance Structure

1. Frames - The frames shall be constructed of 14-gauge sheet steel.

2. Doors - The doors shall be constructed of 16-gauge sheet steel, not less than 1-1/4" thick, reinforced to accept hangers, interlocks or door closers.
3. Equip all hoistway landing doors with one-piece full height non-vision wings of material and finish to match hall side of door panels.
4. Entrances shall bear 1 ½ hour label of Underwriters Laboratories, Inc.
5. Provide each door panel with two removable laminated plastic composition guides, arranged to run in sill grooves with a minimum clearance, replaceable without removing the door from the hangers and incorporating a steel fire stop.
6. In multi-speed door arrangements, provisions shall be made to interlock the individual panels so all panels close should the normal door panel relating means fail.
7. Provide rubber bumpers at the top and bottom of the door to stop them at their limit of travel in opening direction.
8. Sills - Provide narrow-type, extruded sills with the nosing approximately one (1) inch deep and running the full length of door travel.

    a. The sills shall be at least 3/8 inch thick.
    b. The wearing surface shall be of a non-slip type.
    c. Rigidly secure the sills to the building construction by means of steel sill support brackets or blocking with necessary metal shimming or adjustments.
    d. Provide and rigidly secure sill support members to the building structure after blocking and leveling them with necessary metal shimming.

        1) Use 5" x 5" x 3/8" angle for the two speed entrances.
        2) If formed sheet steel sill support members are used, the structural properties of these members shall match or exceed the structural properties of 5”x 5” x 3/8” angle for the two speed entrances.

9. Struts - Provide 3" x 3" x 1/4" hot rolled steel angle struts.

    a. If formed sheet steel struts are used, the structural properties of formed struts shall match or exceed the structural properties of 3" x 3"x 1/4" steel angle.
    b. Extend the struts from top of sill to either the bottom of floor beam or intermediate framing above.
    c. Bolt struts in place with not less than two (2) bolts at each end.
    d. Strut clip angles or brackets shall have a thickness not less than the thickness of the supported strut.

10. Track Support - 3/16-inch-thick steel track support plate shall extend between and be bolted to the vertical steel struts with no less than two (2) bolts at each end.
11. Track Covers – 14-gauge steel cover plates shall extend the full travel of the doors.

    a. Covers shall be made in sections for service access to hangers, sheaves, tracks and interlocks.
    b. The sections above the door opening shall be movable from within the elevator car.
    c. Cover fastening devices shall be non-removable from the cover.

12. Fascia – 14-gauge steel fascia plates shall extend at least the full width of the door and be secured at hanger support and sill with oval head machine screws.

    a. Provide fascia plates where the clearance between the edge of the loading side of the platform and the inside face of the hoistway enclosure exceeds the code allowed clearance.

13. Toe Guards - Provide 14-gauge steel toe guards to extend twelve (12) inches below any sill not protected by fascia.

    a. The toe guards shall extend the full width of the door and shall return to the hoistway wall at a 15-degree angle and be firmly fastened.

14. Dust Covers - Provide 14-gauge steel dust covers to extend six (6) inches above any header not protected by fascia.

a. The dust covers shall extend to a full width of travel of the doors, return to the hoistway wall at a 15-degree angle and be firmly fastened.

B. Tracks / Hangers / Closers / Related Equipment

1. Formed or extruded steel landing door hanger tracks shall be provided.
2. Each landing door panel shall be suspended from a pair of door hanger assemblies that are compatible with the hanger tracks.

a. Hanger assemblies shall be directly mounted to the door panel using 3/8" diameter or better hardware.
b. Solid steel blocks shall be used where job-site conditions dictate the use of spacers between hanger assemblies and the landing door panel.
c. Hanger assemblies shall be adjusted or shimmed so that door panels are suspended in a plumb manner with no more than 3/8" vertical clearance to the cab entrance threshold.
d. Upthrust rollers shall be adjusted for minimal operating clearance against the bottom edge of the hanger track.
e. Means shall be provided to prevent hangers from jumping the track.
f. Blocks shall be provided to prevent rollers from overrunning the end of the track.

3. Each set of multi-speed side slide landing doors shall be provided with a sill-mounted spring closing mechanism with necessary door panel relating hardware.
4. In multi-speed door arrangements, provisions shall be made to interlock the individual panels so all panels close should the normal door panel relating means fail.

C. Interlocks / Unlocking Devices

1. Each set of landing doors shall be provided with a complete electromechanical interlock assembly.

a. Each interlock assembly shall consist of:

1) A switch housing with contacts.
2) Lock keeper.
3) Clutch engagement/release subassembly.
4) Associated linkages.

b. Arrange the lock so that individual leading door panels (side slide or center opening) are locked when in the closed position.

2. Non-typical mounting arrangements for interlocks and/or related mechanisms must receive prior approval from the Consultant.
3. Each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing a drop-leaf type of access key at all landings served.

a. Each hoistway door shall accommodate manufacturers standard lock release key with escutcheon.

1) The keyhole shall be fitted with a metal ferrule that matches the door finish.
2) Drilling key holes in the field will not be accepted.

2.8 CAR EQUIPMENT / FRAME

A. Car Frame and Platform

1. The car frame shall be made of steel members, with the required factor of safety.

2. The car platform shall consist of a steel frame with necessary steel stringers, all securely welded together.
3. The frame and platform shall be so braced and reinforced that no strain will be transmitted to the elevator car.
4. Passenger Elevators

    a. Provide platform with two (2) layers of 3/4" thick marine grade plywood.
    b. Cover the underside of the car platform with sheet steel.
    c. The support frame shall carry rubber pads on which the platform shall rest without any connection to the steel frame for sound and vibration isolation.
    d. Provide extruded an stainless steel threshold having non-slip surface, guide grooves.
    e. Recess the platform to receive finished flooring as selected by the Architect and specified under another section of their specification.
    f. The car frame shall be sized for an 8’-0” overall cab height.
    g. Design the elevator frame and platform for a Class A freight loading.

B. Car Safety

1. Provide a governor actuated mechanical safety device mounted under the car platform and securely bolted to the car sling.
2. The car safety shall be sized for the capacity and speed noted herein.

    a. When tripped, the safety mechanism shall engage the rails with sufficient force to stop a fully loaded car with an average rate of retardation within the limits given in A17.1 Safety Code as adopted and/or otherwise modified by the AHJ.

3. Install a car safety marking plate of corrosion resistant metal and, in addition to the data required by Code, indicate the manufacturer's name and manufacturer's catalog designation number for safety.
4. Make provisions to release the car safety. In no event shall the safety be released by downward motion of the car. Raising the car to reset the safety shall be allowed.
5. Provide an electrical safety plank switch that will interrupt the power to the hoist machine and apply the machine brakes when the safety is set.

C. Automatic Leveling / Releveling / Positioning Device

1. Equip the elevator with a floor leveling device which shall automatically bring the car to a stop within 1/4” of any floor for which a stop has been initiated regardless of load or direction of travel.
2. This device shall also provide for releveling which shall be arranged to automatically return the elevator to the floor in the event the elevator should move below or above floor level in excess of 1/4”.
3. This device shall be operative on all floors served and whether the hoistway or car door is open or closed provided there is no interruption of power to the elevator.
4. A positioning device shall be part of the controller microprocessor systems.

    a. Position determination in the hoistway may be through fixed tape in the hoistway or by sensors fitted on each driving machine to encode and store car movement.
    b. Design the mechanical features and electrical circuits to permit accurate control and rapid acceleration and retardation without discomfort.

5. Where there are consecutive floors/stops that are short stops, the system shall be capable of distinguishing between the two landing zones without error.
6. All equipment and logic required for leveling system to properly function with short stops shall be included.

D. Top-of-Car Inspection Operating Station

1. An inspection operating station shall be provided on top of the elevator car.

2. This station shall be installed so that the controls are plainly visible and readily accessible from the hoistway entrance without stepping on the car.
3. When the station is operational, all operating devices in the car shall be inoperative.
4. Provide the following control devices and features:

    a. A push/pull or toggle switch designated “EMERGENCY STOP” shall be arranged so as to prevent the application of power to the hoist motor or machine brake when in the “off” position.
    b. A toggle switch designated “INSPECTION” and “NORMAL” to activate the top of car Inspection Service Operation.
    c. Push button designated “Up”, “Down” and “Enable” to operate the elevator on Inspection Service (the “Enable” button shall be arranged to operate in conjunction with either the “Up” or “Down” button).
    d. An indicator light and warning buzzer that are subject to activation under Phase I - Fire Emergency Recall Operation.

E. Load Weighing Device

1. Provide means to measure the load in the car within an accuracy of ± 4% of the elevator capacity.
2. Provide one of the following types of devices:

    a. A device consisting of four (4) strain gauge load cells located at each corner of the car platform and supporting a free-floating car platform and cab with summing circuits to calculate the actual load under varying conditions of eccentric loading.
    b. A strain gauge device located on the crosshead, arranged to measure the deflection of the crosshead and thus determine the load in the car.
    c. A device consisting of four (4) strain gauge load cells, supporting the weight of the elevator machine with summing circuits to calculate the actual load under varying conditions of load.
    d. A device to measure the tension in the elevator hoist ropes and thus determine the load in the car.

3. Arrange that the output signal from the load weighing device be connected as an input to the signal and motor control systems to pre-torque of the hoisting machine motors where applicable.
4. Provide audible and visual signals in connection with the load weighing device when used as an “overload” device.

F. Car Enclosure Work Light / Receptacle

1. The top and bottom of each car shall be provided with a permanent lighting fixture and 110-volt GFI receptacle.
2. Light control switches shall be located for easy accessibility from the hoistway entrance.
3. Where sufficient overhead clearance exists, the car top lighting fixture shall be extended no less than 24” above the crosshead member of the car frame.
4. Light bulbs shall be guarded so as to prevent breakage or accidental contact.

G. Master Door Power Operator System – VVVF/AC

1. Provide a heavy-duty master door operator on top of the elevator car enclosure for power opening and closing of the cab and hoistway entrance door panels.
2. The operator may be of the pivot/lever or belted linear drive type.
3. Operator shall utilize an alternating current motor, controlled by a variable voltage, variable frequency (VVVF) drive and a closed-loop control with programmable operating parameters.

    a. System may incorporate encoder feedback to monitor positions with a separate speed sensing device or an encoderless closed-loop VVVF-AC control to monitor motor parameters and vary power applied to compensate for load changes.

4. The type of system shall be designated as a high-speed operator, designed for door panel opening at an average speed of two (2.0) feet per second and closing at approximately one (1.0) foot per second.

a. Reduce the closing speed as required to limit kinetic energy of closing doors to within values permitted by ASME A17.1 as may be adopted and/or modified by the AHJ.

5. The door shall operate smoothly without a slam or abrupt motion in both the opening and closing cycle directions.

   a. Provide controls to automatically compensate for load changes such as:

      1) Wind conditions (stack effect).
      2) Use of different weight door panels on multiple landings.
      3) Other unique prevailing conditions that could cause variations in operational speeds.

   b. Provide nudging to limit speed and torque in conjunction with door close signaling/closing and timing devices as permitted by ASME A17.1 as may be adopted and/or modified by the AHJ. Nudging shall be initiated by the signal control system and not from the door protective device.

6. In case of interruption or failure of electric power from any cause, the door operating mechanism shall be so designed that it shall permit emergency manual operation of both the car and corridor doors only when the elevator is located in the floor landing unlocking zone.

   a. The hoistway door shall continue to be self-locking and self-closing during emergency operation.
   b. The door operator and/or car door panel shall be equipped with safety switches and electrical controls to prevent operation of the elevator with the door in the open position as per ASME A17.1 Code Standards.
   c. Provide zone-lock devices as required by ASME A17.1 as may be adopted and/or otherwise modified by the AHJ.

7. Construct all door operating levers of heavy steel or reinforced extruded aluminum members.
8. Belts shall be designed for long life and to operate noise free.
9. All components shall be designed for stress and forces imposed on the related parts, linkages and fixed components during normal and emergency operation functions.

   a. All pivot points, pulleys and motors shall have either ball or roller-type bearings, oilite bronze bushings or other non-metallic bushings of ample size.

10. Provide operating data / data tag permanently attached to the operator as required by applicable code and standards.

H. Door Reopening Device / “3D”

1. Provide a combination infrared curtain and 3D door protection system.
2. The door shall be prevented from closing and will reopen when closing if any one of the curtain light rays is interrupted or should an object enter the 3D detection zone.
3. The door shall start to close when the protection system is free of any obstruction.
4. The infrared curtain and 3D zone protective system shall provide:

   a. Protective curtain field not less than 71” above the sill.
   b. 3D protective zone field not less than 61” above the sill.
   c. Accurately positioned infrared lights to conform to the requirements of the applicable handicapped code.
   d. Modular design to permit on board test operation and replacement of all circuit boards without removing the complete unit.
   e. Self-contained, selectable 3D zone timeout feature to allow for closing at nudging speed with audible signal.
   f. Automatic turning-off of the 3D zone in the event of three (3) consecutive 3D triggers.

      1) Light curtain shall continue to operate after 3D system timeout.

   g. Selectable control of the 3D zone operation on an “always-on” or “as doors close” basis.

h. Controls to shut down the elevator when the unit fails to operate properly.
i. Provide audible and visual notification of pending door close.

2.9 FINISH / MATERIALS / SIGNAGE

A. Material, Finishes and Painting

1. General

a. Cold-rolled Sheet Steel Sections: ASTM A366, commercial steel, Type B
b. Rolled Steel Floor Plate: ASTM A786
c. Steel Supports and Reinforcement: ASTM A36
d. Aluminum-alloy Rolled Tread Plate: ASTM B632
e. Aluminum Plate: ASTM B209
f. Stainless Steel: ASTM A167 Type 302, 304 or 316
g. Stainless Steel Bars and Shapes: ASTM A276
h. Stainless Steel Tubes: ASTM A269
i. Aluminum Extrusions: ASTM B221
j. Nickel Silver Extrusions: ASTM B155
k. Bronze Sheet: ASTM B36(36M) alloy UNS No. C2800 (Muntz Metal)
l. Structural Tubing: ASTM A500
m. Bolts, Nuts and Washers: ASTM A325 and A490
n. Laminated / Safety Tempered Glass: ANSI Z97.1

2. Finishes

a. Stainless Steel

1) Satin Finish: No. 4 satin, long grain.

b. Sheet Steel:

1) Shop Prime: Factory-applied baked on coat of mineral filler and primer.
2) Finish Paint: Two (2) coats of low sheen baked enamel, color as selected by the Architect.
3) Steel Equipment: Two (2) coats of manufacturer's standard rust-inhibiting paint to exposed ferrous metal surfaces in both the hoistway and pit that do not have galvanized, anodized, baked enamel, or special architectural finishes.

3. Painting

a. Apply two (2) coats of paint to the control room and pit floors**.**
b. Apply two (2) coats of clear lacquer to bronze or similar non-ferrous materials to prevent tarnishing during a period of not less than twelve (12) months after initial acceptance by the Owner or Agent.
c. Identify all equipment including buffers, car apron, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with the background to which it is applied. The identification shall be either decalcomania or stencil type.
d. Paint or provide decal-type floor designation not less than four (4) inches high on hoistway doors (hoistway side), fascia and/or walls as required by A17.1 as may be adopted and/or modified by the AHJ. The color of paint used shall contrast with the color of the surface to which it is applied.

B. Hoistway Entrances

1. Entrance Frames:

a. Passenger Elevator PE1 at All Floors: Provide stainless steel with No. 4 finish standard bolted type construction having matching end caps. Provide a 2" wide square profile.

2. Door Panels:

a. Passenger Elevator PE1 at All Floors: Stainless steel with No. 4 finish.

3. Entrance Sills:

1) Passenger Elevator PE1 at All Floors: Extruded stainless steel.

C. Designation and Data Plates, Labeling and Signage.

1. Provide an elevator identification plate on or adjacent to each entrance frame where required by the AHJ.

a. The designation numeral shall be a minimum of 3” in height.

2. Provide floor designation cast plates at each elevator entrance, on both sides of the jamb at a height of sixty (60) inches to the baseline of floor indication.

a. Floor number designations and Braille shall be 2” high, 0.03” raised and stud mounted.

3. Identify the designated medical emergency services elevator with 3” high international symbol at each elevator entrance on both sides of the jamb.
4. Provide raised designations and Braille markings to the left of the car call and control buttons of the car operating panel(s).

a. Designations shall be a minimum of 5/8” high, 0.03” raised and stud mounted.

5. Provide elevators with data and marking plates, labels, signages and refuge space markings complying with A17.1 Elevator Safety Code as may be adopted and/or otherwise modified by the AHJ.
6. Architect shall select the designation and data plates from manufacturer’s or a third party’s premium line of plates.

2.10 FIXTURES / SIGNAL EQUIPMENT

A. General - Design and Finish

1. The design and location of the hall and car operating and signaling fixtures shall comply with the ADAAG and local requirements of the AHJ.
2. The operating fixtures shall be selected from the manufacturer's or a third party’s premium line of fixtures.
3. The layout of the fixtures including all associated signage and engraving shall be as approved by the Owner / Architect.
4. Where no special design is shown on the drawings, the buttons shall be as follows:

a. Stainless steel, round tamperproof type with positive stop as selected by the Architect from the manufacturer's or a third party’s premium line of push buttons.
b. The button shall have a collar with LED call registered light. Color of illumination to be selected by the Architect

5. Where no special design is shown on the drawings, the faceplates shall be as follows:

a. Passenger Elevator PE1

1) All Floors - 1/8" thick stainless steel with No. 4 finish.

6. Mount elevator fixtures with tamperproof screws. The screw and key switch cylinder finishes shall match faceplate finish.
7. Where key-operated switch and or key operated cylinder locks are furnished in conjunction with any component of the installation, four (4) keys for each individual switch or lock shall be furnished, stamped or permanently tagged to indicate function.
8. All caution signs, pictographs, code mandated instructions and directives shall be engraved and filled with epoxy in code required colors.

B. Car Operating Panel

1. Provide a main car operating push button panel on the inside front return panel of the cab.
2. The car operating panel shall be flush mounted with swing type, one-piece faceplate with heavy-duty concealed hinges.

   a. Mount all key switches that are required to operate and maintain the elevators exposed on the car station except those specified within a locked service cabinet.

3. The push buttons shall become individually illuminated as they are pressed and shall extinguish as the calls are answered. Color if illumination to be selected by the Architect.
4. The operating panel shall include:

   a. A call button for each floor served, located not more than 48” above the cab floor.
   b. “Door open” / “Door close” / buttons.
   c. “Alarm” button, interfaced with emergency alarm. The alarm button shall illuminate when pressed. Locate 35” above the cab floor.
   d. “Emergency Stop” switch per local law located at 35” above the cab floor.
   e. Self-dialing, hands-free emergency communication system actuation button with call acknowledging feature and ASME A17.1/ADA/IBC design provisions.
   f. Three (3) position firefighter key operated switch, call cancel button and illuminated visual/audible signal system with mandated signage engraved per ASME A 17.1 Standards as modified by the AHJ.

5. Locked Firemen’s’ Service cabinet, keyed in accordance with local Code, containing required devices and signals in accordance with ASME A17.1 Standards. The door shall be self-locking.

   a. The automatic opening of the locked cabinet door may be provided with signals initiated by the fire detection and alarm system where approved by the Authority Having Jurisdiction.

6. Provide a locked service cabinet with flush mounted door and containing the suitably identified key switches required to operate and maintain the elevator, including, but not limited to:

   a. Independent service switch.
   b. Light switch.
   c. Fan switch.
   d. G. F. I. duplex receptacle.
   e. Emergency light test button and indicator.
   f. Inspection Service Operation key switch.
   g. Port for hand-held service tool where applicable.

7. Car operating panel shall incorporate:

   a. An integral (no separate faceplate) digital L.E.D. floor position indicator.
   b. An emergency light fixture without a separate faceplate and black-filled engraved unit I.D. number or other nomenclature, as approved by Owner.

c. Provide engraving as follows:

1) A “No Smoking” advisory.
2) Elevator number
3) City identification number if applicable
4) The rated passenger load capacity in pounds.
5) Flood operation signal
6) The number of persons on passenger elevators and freight elevators approved for passenger use based on the capacity divided by one hundred sixty (160) pounds per person.
7) Phase 2 cabinet door engraving

8. Equip the car operating panel with security car call proximity card reader to disconnect the corresponding floor push buttons.

a. Security system shall be overridden by Phase II Firefighter’s Emergency Operations in accordance with code.

9. Where posting of an advisory is permitted by the Governing Authority in lieu of the inspection certificate, engrave the following advisory on the hinged cover of the service cabinet, or where otherwise directed by the Owner.

a. The Elevator Certificate is On File in the Building Management Office.

10. Post Inspection Certificate behind an opening in the car operating panel that is fitted with a flush-mounted clear Plexiglas without an exposed frame.

C. Car Position Indicator

1. The position of the car in the hoistway shall be indicated by the illumination of the position indicator numeral corresponding to the floor at which the car has stopped or is passing.

a. Provide 2” high, 10-segment LED type position indicator with direction arrows, integral with the car operating panel. Lens color and color of illumination to be selected by the Architect.
b. Provide Lexan cover lens with hidden support frame behind fixture plate to protect the indicator readout.
c. Provide audible floor passing signal per ADA standards where not provided by the elevator signal control.

D. Car Direction Lantern

1. Provide a car riding lantern with visual and audible signal in the edge of the return post.
2. The lens shall project a minimum of 1/4” and shall be of solid Plexiglas. Lens design to be selected by the Architect. Color of illumination to be selected by the Architect
3. Use tamperproof screws with surface mount faceplate.
4. Car lantern shall indicate the direction of travel when doors are 3/4 open.
5. The unit shall sound once for the “up” direction and twice for the “down” direction.

a. Provide an electronic chime with adjustable sound volume.

E. Corridor Push Button Stations / Riser

1. A riser of push button signal fixtures shall be provided on all floors.
2. Each signal fixture shall consist of the following:

a. A flush-mounted faceplate.
b. Illuminating tamper-resistant push buttons measuring 3/4” at their smallest dimension as selected by the Owner.
c. A recessed mounting box, electrical conduit and wiring.

3. Intermediate landings shall be provided with fixtures containing two (2) push buttons while terminal landings shall be provided with fixtures containing a single push button.
4. Include firefighter key switch in the main lobby level station or other designated recall landing fixture.
5. Include a flood operation signal.
6. Include “In Case of Fire Do Not Use Elevators” pictograph as an integral part of the faceplate.
7. Push button signal fixtures shall be installed within ADA reach range above the floor and shall be installed both plumb and flush to the finished wall.

    a. Standardize the final distance on all floors.

8. Fixture faceplates shall be installed adjacent to the entrance frame on the front wall.
9. Provide a digital floor position indicator with 1” high numerals at the main lobby landing.
10. Allocate card reader space in each hall station as directed by the Architect. Provide a flush Lexan lens and mounting provisions for the card reader unit which will be provided by others

F. Hoistway Access Switch

1. Install a cylindrical type of keyed switch at the top terminal in order to permit the car to be moved at slow speed with the doors open to allow authorized persons to obtain access to the top of the car.
2. Where there is no separate pit access door, a similar switch shall be installed at the lowest landing in order to permit the car to be moved away from the landing with the doors open in order to gain access to the pit.
3. Locate the switch in the terminal floor entrance jambs with faceplate at a height of 72” above the finished floor.
4. This switch is to be of the continuous pressure spring-return type and shall be operated by a cylinder type lock having not less than a five (5) pin or five (5) disc combination with the key removable only in the “OFF” position.

    a. The lock shall not be operable by any key which operates locks or devices used for other purposes in the building and shall be available to and used only by inspectors, maintenance men and repairmen in accordance with A17.1 applicable Security Group.

2.11 CAR ENCLOSURES

A. Passenger Elevator PE1

1. Wall Panels:

    a. 3/4" thick fire-retardant plywood or particleboard with all surfaces faced with 5WL rigidized stainless steel or stainless-steel No. 4 finish as selected by the Architect. The panels shall be constructed as the removable type.

2. Front Return Panels and Transom: Stainless steel No. 4 finish fixed type front return panel.

    a. Provide stainless steel No. 4 finish transom and entrance posts

3. Cab Doors: Stainless steel with No. 4 finish.
4. Ceiling:

    a. Suspended 3/4" thick fire-retardant plywood or particleboard with all surfaces finished in Stainless Steel No. 4 finish.

5. Handrails:

    a. Two rows of flat 1/4" x 4" Stainless Steel No. 4 finish handrail at the side and rear walls.

6. Lighting:

    a. Fully recessed LED down light fixtures with aluminum alzak reflector. Provide a light fixture in each ceiling panel.

7. Base: Provide a 4" high stainless steel No. 4 finish base at the sides and rear of each cab enclosure

B. Elevator Cab / General Design Requirements

1. The design, materials and finishes of the cab enclosures shall be as shown on the Architectural Drawings.
2. Materials:

    a. Particleboard: Premium grade, AWI, Section 200, fire retardant treated, equal to Duraflake FR

3. Steel Shell: 14-gauge furniture steel reinforced and designed to accept finished wall panels. Finish shell panels with one coat of rust inhibitive primer and two (2) coats of enamel paint in accordance with Section 09900. Apply 1/8" thick, rubberized sound deadening material to the hoistway side of the shell.

    a. All panels shall have minimum radius. Apply sealant beads to panel joints before bolting together with lock washers.

4. Canopy: Canopy construction methods shall match the shell walls. Use 12-gauge furniture sheet steel and adequately support canopy to comply with the loading requirements of the Code.

    a. Provide necessary cutouts for the installation of fan and top emergency exit. Arrange exit panel to swing up using a heavy-duty piano hinge.
    b. The exit panel shall have dual locks, necessary stops and a handle.
    c. When in the locked position, the panel shall be flush with the interior face of the canopy with hairline joints.

5. Base: Where finished base provided under another section of these specifications, recess and prepare the shell to accept the base.

    a. Provide concealed vent slots above side and rear wall base for proper ventilation. Arrange and size vent slots for quiet operation without any whistling. Use 16 gauge baffles to protect the hoistway side of the vent slots.
    b. The elevator cab shop drawings shall include elevator vent calculations and number, location and size of top and bottom vent holes.

6. Flooring: Where finished flooring is provided under another section of these specifications, recess and prepare sub-flooring to accept the finished flooring.
7. Front Return Panels, Entrance Posts and Transom: Use 14-gauge furniture sheet steel with proper reinforcing to prevent oil canning.

    a. Fixed type return panel shall have required cutouts for car operating and signaling fixtures.
    b. Transom shall be 14 gauge and be reinforced and constructed the same as the front return panels.
    c. Construct entrance posts for the passenger elevators from 12-gauge sheet steel and reinforce to maintain vertical alignment with the adjacent panels.

8. Cab Doors: Standard 1" thick, 14-gauge hollow metal flush construction, reinforced for power operation and insulated for sound deadening. Paint hatch side of doors black and face cab side with 16-gauge sheet steel in selected material and finish.

    a. The door panels shall have no binder angles. All welds shall be continuous, ground smooth and invisible.
    b. Drill and reinforce doors for installation of door operator hardware, door protective device, door gibs, etc.

9. Ceiling: Construction techniques for wall panels shall apply to ceiling panel construction. Locate the top emergency exit inconspicuously. Construct and mount the exit panel to prevent light leakage around the perimeter of panel.
10. Ventilation: The ventilation system of the exhaust type shall be provided in each elevator.

    a. The system shall include a blower driven by a directly connected motor and mounted on top of car with isolation to effectively prevent transmission of vibration to the car structure. The blower shall have not less than two (2) operating speeds. The ventilation system shall be sized to provide one (1) air change per minute at low speed and one and one-half (1.5) air changes per minute at high speed. The unit design and installation shall be such that the maximum noise level, when operating at high speed, shall not exceed 55 dBA approximately three (3) feet above the car floor. A three (3)-position switch to control the blower shall be provided in the service panel.
    b. The fan or blower shall start upon the pressing of a car or landing call button and shall stop a predetermined time (approximately two [2] minutes) after the car has answered the last registered call.
    c. The cab ventilation fan shall be designed not to consume more than .33 watts per CFM while operating at maximum speed.

11. Lighting: Arrange lighting fixtures and ceiling assembly to provide even illumination without hot spots and shadows. Overlap fluorescent lamps where cove lighting is specified.

    a. Design and configure lighting system to facilitate maintenance of the fixtures.
    b. Cab lighting source shall be designed to provide a minimum of 35 lumens per watt.
    c. When an unoccupied elevator has remained stationary for fifteen (15) minutes, the cab lighting shall become de-energized. The control system shall automatically re-energize the lighting system upon opening of the cab door.

12. Handrails: All attachment hardware shall match the selected handrail and shall permit handrail removal from within the cab.

    a. Provide a minimum of 10-gauge plate at the hatch side of the shell, aligned with the handrail attachment points, to assure secure handrail mounting.
    b. Design handrail attachment system to support the weight of a person (two hundred fifty [250] pounds) sitting on it without any deflection and damage to the handrail, cab panel and the shell.

13. Protective Pads and Pad Hooks/Buttons: Provide a complete set of cab protection pads with pad hooks/buttons as directed by the Architect. Protective pads shall cover the front return panels, and the side and rear walls. Provide cutouts in pads for access to the cab operating and signaling devices. Pads shall be fire-resistant canvas with two (2) layers of cotton batting padding.

    a. Identify each pad by elevator number and wall location.

14. Accessories: Construct elevator cab to accommodate the door operator, hangers, interlocks and all accessory equipment provided under other sections of these specifications, including firefighter phones, card readers and CCTV.
15. All cab materials shall conform to the code prescribed flame spread rating and smoke development requirements.

C. Cab Fabrication and Installation

1. Maintain accurate relation of planes and angles with hairline fit of contacting panels and/or surfaces.
2. Any shadow gaps (reveals) between panels shall be consistent and uniform.
3. Unless otherwise specified or shown on the drawings, for work exposed to view use concealed fasteners.
4. The maximum exposed edge radius at corner bends shall be 1/16". There shall be no visible grain difference at the bends.
5. Form the work to the required shapes and sizes with smooth and even curves, lines and angles. Provide necessary brackets, spacers and blocking material for assembly of the cab.

6. Interior cab surfaces shall be flat and free of bow or oil canning. The maximum overall deviation between the low and high points of 24" x 24" panel section shall not exceed 1/32".
7. Make weights of connections and accessories adequate to safely sustain and withstand stresses to which they will be subjected.
8. All steel work except stainless steel and bronze materials shall be painted with an approved coat of primer and one (1) coat of baked enamel paint.
9. Cab Finish Warranty Enhancement

    a. Contractor shall be responsible for engineering and installing interior cab finishes in a manner that will withstand all code mandated inspections and test procedures. Failure of finishes during testing shall be repaired by the contractor without expense to the owner. Any objections or qualifications to material selection or design shall be identified during the engineering of the cab interior drawings for review by the owner.

2.12 EMERGENCY LIGHTING / COMMUNICATIONS / SIGNALING

A. Battery Back Up Emergency Lighting Fixture and Alarm

1. Provide a self-powered emergency light unit.

    a. The light fixture shall contain a minimum of two (2) LED lamps. Flush mount the light fixture in the main car station. The fixture shall have a milk white lens.

2. Provide a car-mounted battery unit including solid-state charger and testing means enclosed in common metal container.

    a. The battery shall be rechargeable nickel cadmium with a ten (10) -year minimum life expectancy. Mount the power pack on the top of the car.
    b. Provide a 6" diameter alarm bell mounted directly to the battery/charger unit and connected to sound when any alarm push button or stop switch in the car enclosure is operated.
    c. The bell shall be configured to operate from power supplied by the building emergency power generator. The bell shall produce a sound output of between 80-90 dBa (measured from a distance of 10') mounted on top of the elevator car.

        1) The activation of this bell shall be controlled by the stop switch and alarm button in the car operating station.
        2) The alarm button shall illuminate when pressed.

3. Where required by Code for the specific application, the unit shall provide mechanical ventilation for at least one (1) hour.
4. The operation shall be completely automatic upon failure of normal power supply.
5. The unit shall be connected to normal power supply for car lights and arranged to be energized at all times, so it automatically recharges battery after use.

B. Emergency Voice Communication / Telephone

1. A hands-free emergency voice communication system shall be furnished in the car mounted as an integral part of the car operating panel.

    a. Necessary wires shall be included in the car traveling cable and shall consist of a minimum of one shielded pair of 20AWG conductors.
    b. 120V power shall be provided to power the hands-free device.

2. The telephone shall be equipped with an auto-dialer and illuminating indicator which shall illuminate when a call has been placed and begin to flash when the call has been answered.

    a. Engraving shall be provided next to the indicator which says “When lit help is on the way".

3. In addition to the standard “Alarm” button, a separate activation button shall be provided on the car operating panel to initiate the emergency telephone and place a call.

    a. The telephone must not shut off if the activating button is pushed more than once.
    b. The telephone shall transmit a pre-recorded location message only when requested by the operator and be provided with an adjustable call time which can be extended on demand by the operator.
    c. Once two-way communication has been established, voice prompts shall be provided which instruct the operator on how to activate these functions as well as alerting the operator when a call is being attempted from another elevator in the building.

4. The system shall be compatible with ring down equipment and PBX switchboards.
5. The system shall be capable of serving as the audio output for an external voice annunciation system.

    a. Conversation levels shall measure 60 dbA or higher and measure 10 dbA above ambient noise levels.
    b. Each device shall be provided with a self-diagnostic capability in order to automatically alert building personnel should an operational problem be detected.

6. The phone shall be able to:

    a. Receive incoming calls from any On-Site Rescue Station (when provided or required).
    b. Receive incoming calls from other off-site locations via the public telephone system.
    c. Acknowledge incoming calls and automatically establishing hands-free two way communications.

        1) If no On-Site Rescue Station is provided, each hands-free device shall have built in line consolidation which will allow up to six (6) elevators to be called individually from outside the building over a single telephone line and up to eighty (80) elevators if an On-Site Rescue Station is provided.

7. The emergency elevator communication system shall require a maximum of one (1) telephone line.

    a. The system must provide line sharing capability to eliminate the need for a dedicated telephone line.
    b. The line sharing function must ensure that the emergency telephones always receive dialing priority even if the line is in use and that the emergency telephones can be called into from an off-site location.

8. The system shall provide its own four-hour backup power supply in case of a loss of regular AC power.
9. The system must provide capability for building personnel to call into elevators and determine the charge state of any backup batteries provided for the emergency telephones.
10. The system must include two way communication between the elevator cab and the control room.
11. Pushing the activation button in any of the elevator car stations will cause any on-site Rescue Station (where provided or required) or security telephone to ring.

    a. If the on-site call is not picked up within thirty (30) seconds, the call will be automatically forwarded to a twenty-four (24)-hour off-site monitoring service.

12. The arrangements and costs of the off-site monitoring and telephone line shall be by others

C. Two-Way Elevator Visual Communication System

1. Contractor to provide a complete system in compliance with Section 2.27.1.1 of ASME A17.1-2019 and local amendments by the Authority Having Jurisdiction.

2. The system shall provide audio and visual communication means, with a digital display in the elevator cab and pushbuttons for registering responses.
3. The system shall also provide a means of observing the elevator cab interior, with full view of floor and displaying the video at the monitoring station.
4. Instructions for use shall be located adjacent to the means of activation (e.g. “PHONE” button). All instructions shall be engraved in accordance with the requirements for fixtures herein before specified. Language shall be submitted to owner for approval during the submittal phase.
5. Systems may utilize common cab components (such as Position Indicators or Door Open/Door Close buttons) where allowed by the AHJ and approved by the Owner.
6. The contractor shall include all wiring as required to provide a complete system. Where conduit runs are provided by others, contractor shall coordinate size and routing with the construction manager.
7. Monitoring station shall be provided in the control room, . And in a location as directed by the Owner. Provide a unit price alternate for additional stations.
8. System shall have the ability for connection to an external line, in accordance with code, for monitoring by a third-party provider. Coordinate with owner regarding location of outside line connection and provide adapters/converters as required to complete connection. Where subscription fees are required, they shall be included within the warranty period pricing and long-term maintenance pricing.
9. Approved Vendors: MAD MosaicONE VMS or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection

1. Study the Contract Documents with regard to the work as specified and required so as to ensure its completeness.
2. Examine surface and conditions to which this work is to be attached or applied and notify the Owner in writing if conditions or surfaces are detrimental to the proper and expeditious installation of the work. Starting the work shall imply acceptance of the surfaces and conditions to perform the work as specified.
3. Verify, by measurements at the job site, dimensions affecting the work. Bring field dimensions which are at variance with those on the accepted shop drawings to the attention of the Owner. Obtain the decision regarding corrective measures before the start of fabrication of items affected.
4. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

3.2 INSTALLATION

A. Installation

1. Install the elevator, using skilled personnel in strict accordance with the final accepted shop drawings and other submittals.
2. Comply with the code, manufacturer’s instructions and recommendations.
3. Coordinate work with the work of other building functions for proper time and sequence to avoid delays and to ensure right-of-way of system. Use lines and levels to ensure dimensional coordination of the work.
4. Accurately and rigidly secure supporting elements within the shaftways to the encountered construction within the tolerance established.
5. Provide and install motor, switch, control, safety and maintenance and operating devices in strict accordance with the submitted wiring diagrams and applicable codes and regulations having jurisdiction.
6. Ensure sill-to-sill running clearances do not exceed 1 ¼” at all landings served.
7. Erect guide rails plumb and parallel with a tolerance of 1/8” (plus or minus 1/16”).
8. Install rails so joints do not interfere with brackets, attachment points and divider beam.

9. Set entrance plumb in hoistway and in alignment with guide rails prior to erection of the front walls.
10. Arrange door tracks and sheaves so that no metal-to-metal contact exists.
11. Reinforce hoistway fascia to allow not more than 1/2" of deflection.
12. Install elevator cab enclosure on platform plumb and align cab entrance with hoistway entrances.
13. Sound isolate cab enclosure from car structure. Allow no direct rigid connections between enclosure and car structure and between platform and car structure.
14. Isolate cab fan from canopy to minimize vibration and noise.
15. Remove oil, dirt and impurities and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascia, toe guards, dust covers and other ferrous metal.
16. Prehang traveling cables for at least twenty-four (24) hours with ends suitably weighted to eliminate twisting after installation.
17. After installation, touch up in the field, surfaces of shop primed elements which have become scratched or damaged.
18. Lubricate operating parts of system as recommended by the manufacturer.

3.3 FIELD QUALITY CONTROL

A. Inspection and Testing

1. Upon completion of each work phase or individual elevator specified herein, the Contractor shall, at its own expense, arrange and assist with inspection and testing as may be required by the A.H.J. in order to secure a permit to operate.

B. Substantial Completion

1. The work shall be deemed "Substantially Complete" for an individual unit or group of units when, in the opinion of the Consultant, the unit is complete, such that there are no material and substantial variations from the Contract Documents, and the unit is fit for its intended purpose.
2. Governing authority testing shall be completed and approved in conjunction with inspection for operation of the unit; a certificate of operation or other required documentation issued; and remaining items mandated for final acceptance completion are limited to minor punch list work not incorporating any life safety deficiencies.
3. The issuance of a substantial completion notification shall not relieve the Contractor from its obligations hereunder to complete the work.
4. Final completion cannot be achieved until all deliverables, including but not limited to training, spare parts, manuals, and other documentation requirements, have been completed.

3.4 PROTECTION / CLEANING

A. Protection and Cleaning

1. Adequately protect surfaces against accumulation of paint, mortar, mastic and disfiguration or discoloration and damage during shipment and installation.
2. Upon completion, remove protection from finished surfaces and thoroughly clean and polish surfaces with due regard to the type of material. Work shall be free from discoloration, scratches, dents and other surface defects.
3. The finished installation shall be free of defects.
4. Before final completion and acceptance, repair and/or replace defective work, to the satisfaction of the Owner, at no additional cost.
5. Remove tools, equipment and surplus materials from the site.

3.5 DEMONSTRATION

A. Performance and Operating Requirements

1. Passenger elevators shall be adjusted to meet the following performance requirements:

   a. Speed: within ±3% in both directions of travel under any loading condition.
   b. Leveling: within ±1/4" as measured between the car entrance threshold and the landing sill on any given floor under any loading condition.
   c. Typical Floor-to-Floor Time: (Recorded from the doors start to close on one floor until they are 3/4 open at the next floor) under various loading conditions.

Passenger Elevator PE1	12.5 seconds.

   d. Door Operating Times

Door Type	Opening	Closing
3'-6" 2SSO	2.3 sec.	3.6 sec.

   e. Door dwell time for hall calls: 4.0 sec with Advance lantern signals.
   f. Door dwell time for hall calls: 5.0 sec without Advance lantern signals.
   g. Door dwell time for car calls: 3.0 seconds.
   h. Reduced non-interference dwell time: 1.0 seconds.

2. Maintain the following ride quality requirements for the passenger elevators:

   a. For speeds up to 1400 fpm, the speed of the car roller guides shall not exceed 500 rpm.
   b. Where pit permits, extend bottom roller guides by not less than one half the distance from the centerline of the upper roller guides to the platform.
   c. Noise levels inside the car shall not exceed the following:

      1) Car at rest with doors closed and fan off - 40 dba.
      2) Car at rest with doors closed, fan running - 55 dba.
      3) Car running at high speed, fan off - 50 dba.
      4) Door in operation - 60 dba.

   d. Vertical accelerations shall not exceed 14 milli-g and horizontal accelerations shall not exceed 20 milli-g.

      1) The accelerometer used for this testing shall be capable of measuring and recording acceleration to nearest 0.01 m/s^2 (1 milli-g) in the range of 0-2 m/s^2 over a frequency range from 0-80 Hz with ISO 8041 filter weights applied. The Accelerometer should provide contact with the floor similar to foot pressure, 60 kPA (8.7psi).

   e. The amplitude of acceleration and deceleration shall not exceed 2.6 - 2.8 $ft./sec^2$.
   f. The maximum jerk rate shall be 1.5 to 2.0 times the acceleration and deceleration.
   g. The maximum velocity which the elevator achieves in either direction of travel while operating under load conditions that vary between empty car and full rated load shall be within ± 3% of the rated speed.

B. Acceptance Testing

1. The Contractor shall provide at least five (5) days prior written notice to the Owner and Consultant regarding the exact date on which work specified in the Contract Documents will reach completion on any single unit of vertical transportation equipment.

2. In addition to conducting whatever testing procedures may be required by local inspecting authorities in order to gain approval of the completed work, and before seeking approval of said work by the Owner, the Contractor shall perform certain other tests in the presence of the Consultant.
3. The Contractor shall provide test instruments, test weights, and qualified field labor as required to safely operate the unit under load conditions that vary from empty to full rated load and, in so doing, to successfully demonstrate compliance with applicable performance standards set forth in the project specifications with regard to:

    a. Operation of safety devices.
    b. Sustained high-speed velocity of the elevator in either direction of travel.
    c. Brake-to-brake running time and floor-to-floor time between adjacent floors.
    d. Floor leveling accuracy.
    e. Door opening/closing and dwell times.
    f. Ride quality inside the elevator car.
    g. Communication system.

4. Upon completion of work specified in the Contract Documents on the last car in any group of elevators, and in conjunction with the aforementioned testing procedures, the Contractor shall carry out additional testing of group dispatch/supervisory control features in the presence of the Consultant.
5. The Contractor shall provide test instruments and qualified field labor as required to successfully demonstrate:

    a. Firefighter and independent service operations.
    b. Restricted access security features and card reader controls.
    c. Zoning operations and floor parking assignments.
    d. Up/down peak operation.

6. After hour tests of systems such as fire service and security systems shall be conducted at no extra cost to the Owner.

END OF SECTION

SECTION 22 01 10

PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE

A. Related Documents
   1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 22 specification sections, Division 23, Division 26, and Division 31 specifications apply to work of this section.

1.2 REFERENCES & INTENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Study all drawings and specifications before submitting bids.
C. Work under this Division includes all essential labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items for proper installation and operation of all systems even though not specifically mentioned or indicated.
D. Field verify all building dimensions. The drawings are not to be scaled for final dimensions. However, the equipment is to be installed substantially as shown.
E. It is the intent of these specifications and drawings to provide for finished systems of the quality specified, properly tested, balanced and ready for operation. This includes all devices and accessories required to make the work complete even though such items may not be expressly shown or specified. Drawings and specifications are complementary and must be so construed to determine the full scope of work.
F. Job site Conditions. The Contractor shall visit the site and familiarize himself with the existing conditions before submitting this bid. Failure to do so does not relieve the Contractor from completing the work as specified herein and after. Requests for additional payments due to the Contractor's failure to allow for work conditions will be rejected.

1.3 WORK INCLUDED

A. The following work is specifically included without limiting the generality implied by these specifications and drawings.
   1. All plumbing scope of work as specified herein and as shown on the plans.
   2. Work includes all piping, supports, anchors, insulation, labeling and identification.
   3. All associated cutting and core drilling. The Plumbing Contractor shall cut floor slabs and remove them where required. The General Contractor shall replace floor slabs where required. The Plumbing Contractor shall seal and/or fire stop penetrations as required.
B. Bidders shall examine equipment plans and specifications and include in their bids all labor and material required for complete installation and connection of equipment which is properly a part of their trade even if it is not provided in the equipment specifications.

1.4 STANDARDS AND CODES

A. All equipment with electrical components shall bear the UL label.
B. The following minimum standards apply wherever applicable:
   1. AGA — American Gas Association, Inc.
   2. ANSI — American National Standards Institute, Inc.
   3. ANSI B31.9 — Building Services Piping Code
   4. ASME/ASME Code Sec.9 — American Society of Mechanical Engineers Boiler and Pressure Vessel Code - Welding and Brazing Qualifications

5. ASTM — American Society for Testing Materials
6. AWWA — American Water Works Association
7. AWWA C651 — Disinfecting Water Mains
8. NBFU — National Board of Fire Underwriters
9. NEC — National Electric Code
10. NEMA — National Electrical Manufacturers Association
11. NFPA — National Fire Protection Association
12. OSHA — Occupational Safety and Health Act
13. MSS — Manufacturer's Standardization Society of the Valves and Fittings Industry
14. UL — Underwriters laboratories, listed Product Directories
15. North Carolina Plumbing Code, 2018 – International Plumbing Code 2015

C. In the event, there are conflicts between specifications and standards or codes, standards or codes shall govern unless specifications are in excess of standards.

1.5 QUALITY ASSURANCE

A. All work shall be accomplished in a neat, workmanlike manner by experienced journeymen. All work shall be performed at such times as are required by the progress of the job.
B. Plumbing equipment and fixture installation shall be by a licensed plumber specializing in performing the work of this section with minimum 3 years' experience.
C. Materials and installation shall be in accordance with North Carolina State Building Code 2018 Edition (Year 2015 of the International Plumbing Code as modified and approved by the NC Building Code Council).

1.6 PERMITS AND FEE

A. Make application for all necessary permits and pay applicable fees.

1.7 STRUCTURAL STEEL AND CONCRETE

A. Structural members may not be pierced without prior written approval of the Engineer.

1.8 WATERPROOFING

A. Waterproofed floors and walls may not be penetrated without prior written approval of the Engineer.

1.9 WORK SCHEDULE

A. Work schedule shall be in accordance with Division 01.

1.10 PROTECTION OF EQUIPMENT

A. Provide all necessary protection and be fully responsible for material and equipment stored or installed on the site. Material or equipment stolen or damaged shall be replaced at no additional cost to the Owner.
B. Provide protection against theft, physical damage and the entry of dirt, water, corrosive fumes into the material and equipment. Maintain protective covers for the duration of construction. Store equipment, such as controls, subject to damage by moisture and temperature extremes in a dry, heated space.

1.11 FIRE SAFETY

A. Fire Watch: Provide a fire watch wherever welding, brazing, cutting or other processes involving an open flame or potential for generating sparks is used. Fire watch shall consist of a person with a 10-pound

carbon dioxide fire extinguisher. While on fire watch, the person so assigned shall have no other duties or assignments.

B. Fire Blanket: In addition to providing a fire watch, use an approved fire blanket to cover any combustible materials in the immediate area.

1.12 GUARANTEES

A. Furnish written guarantee in accordance with requirements of General Conditions. Partial approval of a portion of work does not affect the validity of guarantee.

1.13 SUBMITTALS

A. It shall be noted that submittals processed by the Engineer are not change orders; that the purpose of submittals is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use. If deviations, discrepancies or conflicts between submittals and the contract documents in the form of design drawing and specifications are discovered either prior to or after submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. The Engineer may also require the contractor to submit samples of proposed or specified equipment for approval, with the samples to be returned to the contractor upon request.

B. Prior to procurement or manufacturing, submit for approval appropriate shop drawings, manufacturer's catalog data, and/or descriptive literature giving performance data, physical size, wiring diagrams, configuration, capacity, installation instructions, dimensions including rough-in dimensions, pipe connection sizes, trim, and finishes material, etc., for all items under this Division.

C. Field verify the characteristics of all specified equipment before preparing shop drawings. This shall include available space, available voltages, suitability of substrate for receiving the specified equipment, etc.

D. Where different products have to work together, it is the contractor's responsibility to select manufacturers whose products are visually or technically compatible.

E. Prepare listing of plumbing fixtures, specialty items, piping materials, identification materials, and insulation for the project. A sample schedule is included at the end of this section to complete this requirement. Provide all information represented. Plumbing materials shall not be delivered to the building until the Designer has inspected and approved the completed listing.

F. Submittals of shop drawings and manufacturer's data, etc. shall be provided to the Engineer electronically in PDF format. The Engineer will review the submittals and return them electronically. The exception would be color samples or other material that cannot be adequately represented electronically, and these should be submitted as five (5) hard copies. The Engineer will review them and return three (3) copies.

1.14 RECORD DOCUMENTS

A. During construction, keep an accurate record of all changes and deviations from contract documents. Upon completion of this installation, the contractor shall submit to the Engineer maintenance manuals and colored scans of the marked-up prints in PDF format indicating any installed work that is different from what is shown on the drawings.

B. These record drawings shall include detailed locations and depths for all below slab pipes.

PART 2 - PRODUCTS

2.1 QUALITY OF MATERIAL

A. Plumbing equipment manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum three years' experience. Equipment of the same general type

shall be of the same make. Brand names and catalog numbers included with equipment or material specifications are used to indicate quality, rating or operating characteristics of the equipment or material.

B. All materials provided shall be new and shall be approved by the Underwriter's Laboratories, Inc. wherever that agency has applicable standards.

PART 3 - EXECUTION

3.1 CLEARANCE AND RESTORATION OF SITE

A. It may be required to temporarily remove existing ceiling tiles, piping, duct, conduits, etc. to introduce new work as specified in this Division. Contractor, after installation of new work, shall reinstall, reconnect removed items to match the existing. Installation of any new equipment shall not compromise existing fire ratings of rated assemblies. All penetrations shall be sealed to existing conditions per UL guidelines for penetration protections. Provide offsets if required in existing piping, ducts etc. to introduce new work.

3.2 COORDINATION

A. Install all work to permit removal or maintenance of equipment and fixtures without damage to the equipment, fixtures, or the building. Verify equipment space requirements, condition of substrate, voltages, etc. at the time of shop drawing submission and advise the Engineer of any conflict.

B. Do not rough prior to receipt of approved shop drawings.

3.3 EQUIPMENT ARRANGEMENT AND SUPPORT

A. Support plumb, rigid and true to line all work, including equipment, fixtures, and piping furnished under this Division. Study thoroughly architectural, mechanical drawings and all related drawings to determine how equipment, fixtures and piping are to be supported, mounted or suspended. Provide extra steel, bolts, inserts, pipe stands, brackets and accessories for proper support as required whether or not shown on drawings. When directed, furnish for approval a drawing showing supports.

B. All gauges, meters and similar items shall be mounted so they are readable without requiring a ladder.

3.4 FINAL ADJUSTMENT AND TESTING

A. General - Provide all testing, preliminary and final adjustment of instrumentation for this purpose. Conduct all tests in full compliance with applicable codes prior to covering or concealing work by insulation, enclosures, etc. Material found to be defective shall not be repaired. It shall be replaced with new material which tests satisfactorily. Defective workmanship only may be corrected after discovery of defect by tests.

B. Working Tests - Subject all equipment and controls to simultaneous and continuous working tests for a period of one day prior to final inspection. Make adjustments, repairs and equipment replacements as required.

3.5 LABELS, IDENTIFICATION AND TAGS

A. Label plumbing equipment and specialty items in conformance with Section 22 05 53 - “Plumbing Identification and Painting”.

3.6 OWNER'S RIGHT TO TEST SYSTEMS

A. Should, in the opinion of the Engineer, and during the guarantee period, reasonable doubt exists as to the proper functioning of any equipment installed under this Contract, the right is reserved for the Owner and Engineer to perform any test deemed practical to determine whether such equipment is functioning

properly and performing at required capacity. If such tests show proper functioning, the cost of the test will be paid by the Owner. If the tests indicate a deficiency in equipment capacity or performance, the Contractor shall pay the cost of the test and also make good any deficiencies shown by the test to the full satisfaction of the Owner and the Engineer.

3.7 CLEANING UP

A. The contractors performing work under this section shall at all times keep the premises and the building in a neat and orderly condition and any instructions of the Engineer in regard to the storing of material, protective measures, cleaning up of debris, etc. shall be explicitly followed. At the completion of the job, all equipment shall be cleaned to the satisfaction of the Engineer.
B. Buildings will be occupied during installation of the new work and/or alterations as described hereinafter. Thus, special care shall be taken during installation to protect equipment and other furniture in the buildings from dust and debris generated during installation of work specified in this Division.

3.8 INSPECTION CERTIFICATES

A. Obtain all inspections required by law, ordinances, rules, and regulations of the authorities having jurisdiction and obtain and furnish to the Engineer certificates of such inspections, pay all fees, charges, and other expenses in connection therewith.

3.9 DESIGNER INSPECTIONS

A. The Designer will make regular site visits during construction and will keep a deficiency log of all observed exceptions. The contractor shall resolve these noted deficiencies as expediently as possible.

3.10 FINAL REVIEW

A. Final review and tests of the completed construction shall be performed in the presence of the Engineer or his representative and shall be at such times as are convenient to the Engineer. Final tests shall show conclusively that all fixtures and equipment perform their intended and specified functions and that all work complies with the provisions of these specifications. All material, equipment, and instruments required for the tests shall be furnished by the Contractor at his own expense.

3.11 MAINTENANCE MANUALS

A. O&M documentation shall be delivered within 60 days of the Contractor receiving approved shop drawings.
B. Maintenance Manuals shall be submitted in three (3) copies in vinyl 3-ring binders, and three (3) copies in electronic format as PDF files on disks. Each manual shall have the following:
    1. Service telephone number of the installing company, including an emergency number.
    2. Contact person, phone number, and address of manufacturer or distributor where equipment was purchased.
    3. The manufacturing company's operating and maintenance manuals for each piece of equipment.
    4. Copies of all approved submittals.
    5. Copies of warrantees with their start dates.
    6. A diagram of all valve locations, giving their identification and function. This shall be submitted to the Engineer for review and approval as part of the O&M manual, and to be mounted as indicated below.
C. Furnish for each building permanent type charts, framed under clear plastic, mounted in the Basement Mechanical Room or where directed as follows:
    1. Service organizations with day and night telephone numbers.
    2. A diagram of all valve locations, giving their identification and function.

PRODUCTS LISTING FORM

INSTRUCTIONS:

Do not use the terminology "as specified"; rather indicate specifically the product proposed.

Prepared by: _____

_____

Date: _____ Project: _____

SPEC. SECTION	ITEM	MANUFACTURER

END OF SECTION

SECTION 22 01 50

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE

A. Related Documents
   1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 22 specification sections, Division 21, Division 23, Division 26, and Division 31 specifications apply to work of this section.
B. Section 23 0510 - Basic Mechanical Requirements.
C. Section 22 0110 – Plumbing General Requirements.

1.2 DESCRIPTION

A. Pipe and fittings shall be in accordance with specifications listed herein and shall be installed as outlined under applicable Divisions of the specifications. Materials shall be new and free of manufacturing defects or damage.

1.3 QUALIFICATIONS

A. The pressure ratings of pipe and fittings shall be compatible with maximum pressures anticipated in respective systems.

PART 2: PRODUCTS

2.1 PIPE AND PIPE FITTINGS (GENERAL REQUIREMENTS)

A. All above grade water piping 3" and smaller shall be ANSI/ASTM B88, Type "L" copper, hard drawn, with the type and manufacturer's name on each piece. Fittings shall be wrought brass or copper. Under no circumstances shall notching or mitering be permitted. Appropriate fittings shall be used for all turns, and joints.
B. All above grade water piping 4” and larger shall be cement lined ductile iron with flanged joints.
C. All below grade water piping 3" and smaller shall be Type "K" copper soft annealed, with the type and manufacturer's name on each piece. Copper tubing which is out of round or kinked will not be acceptable.
D. Below grade water piping is also permitted to be cement lined ductile iron pipe meeting the requirements of ANSI-AWWA C151/A21.51-91, thickness class 50 or greater. Refer to Section 221000 – Plumbing Piping and Specialties for more details.
E. Roof Leader, Storm Drain, Sanitary Soil, Waste and Vent Piping:
   1. New roof leader, storm drain, sanitary soil, waste and vent piping shall be PVC below grade or cast iron above grade as indicated below. New piping may need to connect to existing piping which is a different type of material. Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type conforming to ASTM C1173, ASTM C1460 or ASTM C1461. Connectors and adapters shall be approved for the application (refer to 2018 NC Plumbing Code section 705.16 and its sub-paragraphs).
   2. Below grade: PVC DWV pipe and fittings: ASTM D 2665, Schedule 40, installation per manufacturer’s instructions, and connect by ASTM D 2564 PVC solvent cement. Use 2-inch minimum size underground.
   3. All 1-1/2" through 8" cast iron soil, waste pipe and house or building sewer lines and fittings shall bear the registered insignia "CI" or "CI No-Hub" indicating that these items used in the sanitary system comply with the Cast Iron Soil Pipe Institute's Standard 301-63T. Universal "Alpha Couplings" or "No-Hub" stainless steel connections shall be used above grade. 1-1/2 and 2-inch galvanized Schedule 40 nipples may be used at wall rough-in for sinks.
   4. Fixture Arms: Schedule 40 galvanized steel pipe with threaded fittings.

2.2 PIPE MATERIAL

A. PVC Pipe and fittings for below ground waste piping.
   1. ASTM D 2665, Schedule 40, installation per manufacturer's instructions, and connect by ASTM D 2564 PVC solvent cement.
B. Cast Iron Soil Pipe and fittings above ground.
   1. Cast iron pipe, CISPI 301, hubless, service weight with cast iron fittings. Joints shall be by heavy duty shielded couplings, as specified ASTM C 1540-2 with stainless steel clamp-and-shield assemblies.
C. Steel Pipe
   1. Black or galvanized, conforming to ASTM A 120 standard weight schedule 40.
D. Copper Piping and Fittings
   1. Water Piping Type L and K - Conforming to ASTM B-88 and hard or soft temper as specified elsewhere.
   2. Water Pipe Fittings - Cast brass ANSI B-16.18.
E. Standard Cast Iron Fittings
   1. 175 PSI WOG, cast iron, screw type, ANSI B-16.4.
F. Cast Iron Drainage Fittings
   1. ANSI B-16.12 drainage pattern, standard weight, screw type. Galvanized where specified.
G. Malleable Fittings
   1. 150 PSI, SWP malleable iron, screw type, ANSI B-16.3.

2.3 ADAPTORS

A. Cast Iron to Screwed Pipe
   1. Half couplings, Schedule 40 steel, galvanized where specified.
B. Cast Iron to Copper
   1. Water Service Piping: Dielectric flanged union iron pipe to copper with insulating gasket, 175 PSI rated iron flanges and dielectric space between iron flange and copper pipe. Epco Sales or approved equal.
C. Copper to Screwed
   1. Provide dielectric flanges or IPT to copper sweat dielectric transition fittings.

2.4 SLEEVES

A. Refer to Specification Section 22 10 00 – Plumbing Piping and Specialties.

2.5 ESCUTCHEONS

A. General: Use chrome-plated B & C Type 40 flush escutcheons on ceiling and wall. At floors, use Ritter No. 36-A deep cup chrome-plated escutcheon. Use Ritter, Grabler, Blaw-Knox, or equal. Escutcheons shall be used at all piping in finished areas. Escutcheons on insulated piping shall fit insulation tightly.
B. For Exposed Flush Valves, Water Supplies, and P-traps: Provide chrome-plated cast brass escutcheons with set screws.

2.6 FLASHING

A. Sheet Lead
   1. Sheet lead for general use shall weigh at least 4 pounds per square foot.
B. Sheet Copper
   1. Sheet copper for general use shall weigh at least 12 ounces per square foot and conform to ASTM B152.

2.7 PIPE SUPPORTS ON ROOF:

A. Support piping on the roof with Model 1.5 Pillow Block Supports by Miro Industries, Inc., B-Line Dura-Blok Rooftop Supports by Cooper Industries, Model MT-1-A8 Single Post Rooftop Pipe Supports by MAPA Products, or approved equal.

PART 3 - EXECUTION

3.1 PIPING JOINTS

A. Connectors and adapters between different types of material for waste and vent piping shall be approved for the application (refer to 2018 NC Plumbing Code section 705.16 and its sub-paragraphs).
B. Cast Iron Soil Pipe (Below Ground)
   1. Neoprene gaskets conforming to ASTM C564, as manufactured by Tyler or Charlotte Pipe Foundries for use on service weight or extra heavy weight soil pipe.
C. Cast Iron Soil Pipe (Above Ground)
   1. No hub coupling type joint for two spigots ends of pipe and/or fittings with neoprene sealing sleeves, stainless steel corrugated shield and stainless-steel clamping band.
D. Threaded Pipe
   1. Clean male and female threads. Make up with approved pipe joint compound applied to male thread only. Lead and wicking will not be allowed.
E. Copper Pipe or Tubing
   1. Domestic Water: Cut tube end square. Ream and remove burrs. Use steel wool or wire brush to clean both tube and cup to a bright metal.
   2. Solder for 1-1/4” Piping and Smaller: Apply non-corrosive flux to outside of tube and inside of cup and solder with 95-5 tin-antimony solder. Remove excess solder. Solder shall be composition Sb5, 95 percent tin, 5 percent antimony conforming to Federal Specifications QQ-S-57 lb. Flux shall be non-corrosive type conforming to Federal Specification O-F-506. Solder containing lead will not be permitted on this project.
   3. Silver Brazing Alloy for 1-1/2” to 2-1/2”: Silver 15%, copper 80%, phosphorous 5%.
F. Flanged Joints
   1. Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

3.2 SLEEVES

A. Provide for all pipes passing through floors, walls and ceilings.
B. Sleeves shall be of sufficient size to receive insulation and of proper length to terminate 1" above finished surfaces.
C. Sleeves for covered lines shall fit over covering without unnecessarily large clearances.
D. Pipe sleeves shall be caulked with non-hardening caulking to prevent transmission of noise between floors and walls.
E. Sleeves for piping from mechanical rooms shall be made air and vapor tight by caulking with UL listed fireproof caulking equivalent to 3M CP 25 N/S.

3.3 ESCUTCHEONS

A. Provide for all exposed piping passing through floors, walls or ceilings of all spaces including equipment rooms.

3.4 FLASHING

A. Vent Piping
   1. Sanitary Vent - Extend vent 12 inches above finished roof surface roof insulation.

END OF SECTION

SECTION 22 05 53

PLUMBING IDENTIFICATION AND PAINTING

PART 1: GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 22 specification sections, Division 23, Division 26, and Division 31 specifications apply to work of this section.

1.2 SCOPE

A. The plumbing contractor shall contract the services of a professional painting subcontractor to do the required painting.
1. Color coded painting of pipes to indicate what is being conveyed in the pipes will not be required.
2. All uninsulated piping and equipment not concealed in chases, crawl spaces, or above ceilings shall be painted to match surroundings, except for copper piping in mechanical or other utilitarian rooms.
3. All insulated piping and equipment exposed to view in public or storage spaces shall be painted unless provided with an aluminum or PVC jacket.
4. The plumbing contractor shall be responsible for labeling the plumbing piping and equipment after it is painted.

B. Identify the following:
1. Domestic cold and hot water piping.
2. All plumbing equipment including valves.
3. All electrical equipment associated with plumbing, including disconnects, panels or sensors.
4. Provide maintenance and emergency repair contact information for all equipment on labels placed on an easily visible location on the equipment or adjacent to the equipment.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's technical product data and installation instructions.

PART 2 - PRODUCTS

2.1 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi- rigid snap-on, color-coded pipe markers, complying with ANSI A13.1. Provide full-band pipe markers, extending 360 degrees around pipe at each location.

B. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance.

C. Size of Pipe Identification:

	OD Pipe or Covering	Length of Background Color Field	Size of Letters
1.	3/4 in. thru 1-1/4 in.	8 in.	1/2 in.
2.	1-1/2 in. thru 2 in.	8 in.	3/4 in.
3.	2-1/2 in. thru 6 in.	12 in.	1-1/4 in.
4.	8 in. thru 10 in.	24 in.	2-1/2 in.
5.	Over 10”	32 in.	3-1/2 in.

D. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.2 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
B. Provide 1-1/2" diameter tags, except as otherwise indicated.
C. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.

2.3 ENGRAVED PLASTIC-LAMINATE SIGNS AND EQUIPMENT MARKERS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes indicated, 1/16" thick, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
B. Fasteners: Self-tapping stainless steel screws.

PART 3 - EXECUTION

3.1 PAINTING

A. All equipment, except where otherwise specifically noted, shall be furnished in prime coat. All uninsulated black steel or cast-iron piping shall be prime coated, and finish painted in light gray unless otherwise required by schedule below to be color coded. All welds, on both insulated and uninsulated piping, shall be painted with one coat of primer. All miscellaneous black steel items such as hangers and rods, machinery supports, breechings and stacks, etc., shall be prime coated and finish painted in light gray. Exposed surfaces of insulation shall be sealed. All metal surfaces shall be thoroughly cleaned of rust and dirt and shall be degreased before application of primer. All prime coated equipment shall be touched up where prime coats are chipped, scratched, or otherwise damaged. All prime coated equipment shall be thoroughly cleaned and left ready for finish painting. Where cast iron accessories or galvanized pipe, or equipment surfaces are to receive finish painting, the item shall be properly primed.
B. Ferrous surfaces shall be painted with the following coats:
   1. 1 coat of primer equivalent to Bruning Silathane 520-14 grey-green primer, Benjamin Moore 06- 20 red oxide alkyd primer or Richards SR-1399 red metal primer.
   2. 2 coats of finish equivalent to Bruning Silathane Gloss Enamel 520-32 quarry gray, Benjamin Moore Gloss Enamel 22-38 or Richards Gloss Enamel 1003 Series.
C. Refer to Division 09 for more information.
D. Finish painting of all equipment and piping (both insulated and uninsulated) shall be provided. Where indicated, or specified, existing equipment, piping, duct, etc. shall be cleaned and painted along with new work. Do not paint piping that is provided with aluminum or PVC jacketing insulation covering. Paint piping insulation per color schedule below and provide stenciled identification or plastic pipe markers.

3.2 IDENTIFICATION SCHEDULE

A. Painting and/or identification shall be in accordance with the following schedule:

	ITEM	IDENTIFICATION	MARKER BACKGROUND COLOR	LETTERING COLOR
1.	Domestic cold water	DCW	Green	White
2.	Domestic hot water	DHW	Yellow	Black

B. Size of lettering shall be the as indicated in paragraph 2.01.C above.
C. All other uninsulated ferrous pipes shall be painted light gray with stenciled identification as specified under stenciling.

3.3 GENERAL PLUMBING IDENTIFICATION

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting.

3.4 PIPING SYSTEM IDENTIFICATION

A. General: Install plastic pipe markers or stenciling on each system indicated to receive identification.
B. Locate pipe markers and color bands or stenciling as follows:
   1. Near each valve and control device.
   2. Near each branch.
   3. Near locations where pipes pass through walls, floors, ceilings, roofs or enter non-accessible enclosures.
   4. Near major equipment items and other points of origination and termination.
   5. Spaced intermediately at maximum spacing of 25' along each piping run, except reduce spacing to 10’ in congested areas of piping and equipment and in mechanical rooms. Lettering shall be readily observable within the room or space where the piping is located.
   6. Exception: Where piping is exposed to public view, identification should be discretely placed for minimal visual impact. Consult Engineer for placement in this type of space.
C. Stenciling: In lieu of plastic pipe markers, stenciling may be used for identification. Apply stenciling after finished painting has been completed. Stencil indication shall be in block letters, applied with black paint (except white paint on dark surface) as follows:
D. Stencil as follows:

	OD Pipe or Covering	Length of Background Color Field	Stencil Letter Size
1.	3/4 in. thru 1-1/4 in.	8 in.	1/2 in.
2.	1-1/2 in. thru 2 in.	8 in.	3/4 in.
3.	2-1/2 in. thru 6 in.	12 in.	1-1/4 in.
4.	8 in. thru 10 in.	24 in.	2-1/2 in.
5.	Over 10”	32 in.	3-1/2 in.

E. All underground lines outside the building footprint, shall have a warning tape installed in the backfill between 6 inches to 24 inches below finished grade directly over piping.
   1. Metallic lines shall be identified with durable printed plastic warning tapes, minimum 3 inches wide, with lettering to identify buried line below.
   2. Non-metallic pipes shall be marked using an approved tracer. A yellow insulated copper tracer wire or other approved conductor shall be installed adjacent to and over the full length of underground nonmetallic piping. Access shall be provided to the tracer wire or the tracer wire shall terminate at the cleanout between the building drain and building sewer. The tracer wire size shall not be less than 14AWG and the insulation type shall be listed for direct burial.

3.5 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system. List each tagged valve in typed valve schedule for each piping system with diagrams showing their locations, and post under glass in main mechanical room and/or boiler room. Valve schedules and diagrams shall also be included in the O&M manuals.
B. The contractor shall provide the designer with a set of drawings with the valve numbers marked at their installed locations throughout the buildings. These valve numbers shall be included on the as-built drawings at the end of the project.

3.6 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Water heater.
   2. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   3. Electrical disconnects for plumbing equipment.

3.7 ACCESS PANEL AND CEILING GRID IDENTIFICATION

A. Install engraved plastic laminate sign or plastic equipment marker on access panels and ceiling grids for concealed plumbing equipment, valves, and other operational devices.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 22 specification sections, Division 23, Division 26, and Division 31 specifications apply to work of this section.

1.2 WORK INCLUDED

A. Provide insulation for piping and equipment installed under this contract, as indicated on the drawings and specified herein, including, but not limited to:
1. Domestic cold and hot water piping, valves and fittings.
2. Exposed drain and hot water piping below handicapped fixtures.

1.3 SUBMITTALS

A. Submit manufacturer's product data on all insulation products specified, including thermal resistance values, flame and smoke ratings, UL listing, and manufacturers published installation recommendations.

1.4 GENERAL REQUIREMENTS

A. For the purpose of this specification, the term "exposed" is generally intended to mean work that is visible in finished spaces and above partially open ceilings. The term "concealed" is generally intended to mean work that is installed behind walls, plastered ceilings, gypsum board ceilings, continuous lay-in ceilings, and under floors.
B. Where subject to freezing, cover piping and fittings with single piece, double the thickness normally specified. Areas "subject to freezing" shall be defined as all unconditioned interior spaces and all above grade outdoor spaces.
C. All insulation, jackets, adhesives, and other insulation materials shall be UL rated, non-combustible, with maximum permanent flame spread rating of 25, and a smoke developed rating of 50 or less and fuel contributed of 50 or less when tested in accordance with ASTM E-84. Submit smoke and flame spread ratings for every material proposed to use.
D. Unless otherwise indicated, insulation thickness or "R" value shall conform to the North Carolina Energy Code.
E. Where differences occur between any referenced standard or code the most stringent requirements shall apply.
F. All products shall be free of asbestos.
G. All piping insulation shall be performed by a company regularly engaged in piping insulation using full time insulation mechanics.

PART 2 - PRODUCTS

2.1 MATERIALS – GENERAL

A. Type 1 - Thermal Pipe Insulation with Jacket. Preformed Fiberglass Pipe insulation complying with ASTM C547, Class 3, rigid, molded pipe insulation, noncombustible. Maximum K-factor of .24 Btu per inch/h-ft^2-°F at mean temperature of 75°F. All insulation shall have a jacket of white kraft paper reinforced with a glass fiber yarn and bonded to an aluminum foil, with self-sealing longitudinal laps and butt strips.

Jacket shall comply with ASTM C1136 (Type 1). Insulation and jacket shall be equal to Johns Manville Micro-Lok with AP-T Plus, PPG Industries, Owens Corning, Certainteed, or Knauf.

1. Insulate all fittings, valves and strainers with molded fittings, mitered segments of pipe insulation or over- sized pipe insulation held in place with wire. Finish in accordance with manufacturer's recommendations to comply with the UL Systems listing. Preformed jackets of PVC material as manufactured by Zeston, Inc., may be used at fittings.
    a. Insulation for valves, fittings and unions shall be the same thickness as the pipe insulation by any of the following methods, including both insulation and cover.
        i. Insulate with one pound per cubic foot density fiberglass blanket wrapped firmly under compression (minimum 2 to 1) and secure with number 20-gauge annealed steel wire.
        ii. Insulate with molded fiberglass fittings secured with number 20-gauge annealed steel wire.
        iii. Miter fiberglass piping insulation to form fittings, secured with number 20-gauge annealed steel wire.
        iv. Cover with Zeston or Johns-Manville premolded one piece PVC fitting covers secured by banding. If additional securing is required, taping and stapling may be used. Covers shall be sealed with vapor barrier pressure sensitive tape. Color to match cover.
        v. Cover with a smooth coating of Johns-Manville no. 375 cement. Open weave glass fabric to be smoothly adhered and coated with lagging adhesive. Lap glass on fabric at least 1" on itself and 2" on adjoining pipe insulation.
        vi. Seal all joints and seams with tape as recommended by manufacturer.

B. Type 2 - Flexible Elastomeric Unicellular Foam Plastic Pipe Insulation.
    1. Material: Preformed elastomeric closed cell vapor barrier insulation, flexible, flame retardant, .27 Btu per inch/h-ft^2-°F thermal conductivity, by testing conforming to ASTM C 177 or C518. Temperature range 40 to 200 degrees F.
    2. Fittings: Sleeve type fitting covers and miter cut pipe insulation or preformed fittings; "Zeston" or equal.
    3. Manufacturers - Make
        a. Armstrong - Armaflex AP or Self Seal 2000
        b. Johns Manville - Aerotube II
        c. PPG Industries - Foamed Plastic Pipe Insulation
        d. K-Flex USA

2.2 EXPOSED DRAIN AND HOT WATER PIPING BELOW HANDICAPPED FIXTURES

A. Features and construction

1. Prefabricated, removable, insulating covers to fit traps, drains, valves and supplies, extensions for drains, and offset tail pieces.
2. Insulating foam liner
3. Heavy gauge vinyl cover
4. Recloseable sealing seams
5. Tamperproof locking straps
6. Weep seams to prevent leakage build-up.
7. Conforms to Uniform Federal Accessibility Standards 4.19.4 GSA and ANSI Document A117-1- 2017.
8. White color

B. Manufacturer

1. Plumberex Specialty Products - Handy-Shield Safety Covers.
2. Brocar Products Inc. - Trap Wrap
3. Trueboro, Inc. – Lav Guard

2.3 FIELD APPLIED JACKETS

A. PVC Jacket: Roll jacketing made from high impact UV-resistant polyvinyl chloride material in 20 mil thickness.
B. Canvas Jacket: UL listed fabric, 8 oz/sq yd, plain weave cotton treated with dilute fire-retardant lagging adhesive.
C. Aluminum Jacket: 0.016-inch-thick sheet, embossed finish, with longitudinal slip joints and 2-inch laps, die shaped fitting covers with factory attached protective liner.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply insulation in strict accordance with manufacturer's instructions.
B. All surfaces must be free of dirt, dust, grease, oil, scale or loose particles before insulation.
C. Do not cover fittings until required tests have been completed and accepted.
D. Insulation shall be continuous passing through walls. Size sleeves accordingly to accommodate insulation. Where insulation passes through floor or wall sleeves, pack the space outside of the insulation and inside of the sleeve with fiberglass blanket. Seal with fire rated sealant on fired rated partitions.
E. For cold lines for condensation protection or for safety protection of hot lines unions shall be insulated as follows: Covering shall be terminated at each end of the union and sealed. Cover union with separate section of insulation, routed out to fit over union, of section of pipe insulation whose inside diameter matches the outside diameter of the adjoining insulation, lap adjoining insulation on both sides by 3", seal vapor tight plastic tape.
F. Provide insulation saddles and shields at hangers to prevent deformation or penetration of insulation by contact with hangers.

3.2 DOMESTIC WATER PIPING

A. Type 2- for cold water piping, 1/2 " thickness for all piping up to an including 1-1/2". 1" thickness for pipes 2" and above.
B. Type 2- Double insulation thickness for cold water piping subject to freezing.
C. Type 1 or Type 2- for hot water piping, 1" thickness for piping up to and including 1", 1-1/2" thickness for all piping larger than 1".
D. On cold water piping, the insulation may switch from Type 2 to Type 1 for the short section of cold water piping going through a rated wall to meet firestopping detail requirements. Thickness to match Type 2 for cold water.

3.3 EXPOSED WASTE AND HOT WATER PIPING AT FIXTURE DESIGNATED HANDICAPPED

A. Prefabricated insulating covers, securely installed in accordance with manufacturer's instructions.

3.4 FIELD APPLIED JACKETS

A. Provide canvas or PVC jackets where piping is exposed to view in occupied spaces.
B. Provide PVC or aluminum jackets where insulated piping is exposed in mechanical, plumbing, storage, or similar utilitarian rooms within 8' of the floor.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 22 specification sections, Division 23, Division 26, and Division 31 specifications apply to work of this section.

1.2 REFERENCED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Specification Divisions and Sections as referenced in Division 22 Section "Plumbing General Requirements", and Division 22 Specification Sections as follows apply to work of this section:
C. Section 220110 - Plumbing General Requirements
D. Section 220150 - Basic Materials and Methods
E. Section 220700 - Plumbing Insulation
F. Section 224000 - Plumbing Fixtures

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
1. AMERICAN GAS ASSOCIATED LABORATORIES (AGA)
a. AGA American Gas Association Laboratories Listing.
2. AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
a. ASSE 1010 Water Hammer Arrestors
b. ANSI/ASSE 1011 Performance Requirements for Hose Connection Vacuum Breakers
c. ASSE 1012 Backflow Preventers with Immediate Atmospheric Vent
d. ASSE 1013 Backflow Preventers, Reduced Pressure Principle
e. ASSE 1019 Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types
3. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
a. ANSI A112.21.1M Floor Drains
b. ANSI A112.21.2M Roof Drains
c. ANSI A112.26.1 Water Hammer Arrestors
d. ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
e. ANSI B16.23 Cast Copper Alloy Solder-Joint Pressure Fittings - DWV
f. ANSI B31.2 Fuel Gas Piping
g. ANSI B31.9 Building Services Piping Code
4. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
a. ANSI/ASHRAE 90.1B Energy Conservation in New Building Design
5. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
a. ANSI/ASME Code Boiler Pressure Vessel Code
b. ANSI/ASME Code Sec.9 Boiler and Pressure Vessel Code -Welding and Brazing Qualifications
c. ANSI/ASME A112.19.8M Certification of Suction Fittings & Drains
d. ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
e. ANSI/ASME B16.3 Malleable-Iron Threaded Fittings, Classes 150 and 300
f. ANSI/ASME B16.4 Cast-Iron Threaded Fittings Class 125 and 250
g. ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

h. ANSI/ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes
i. ANSI/ASME B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
j. ANSI/ASME B16.32 Cast Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems

6. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
   a. ASTM A 47 Ferritic Malleable Iron Castings
   b. ASTM A 53 Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
   c. ASTM A 74; CIS {O 3-1, Cast Iron Soil Pipe and Fittings ASTM A888
   d. ASTM A 234/A234M Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
   e. ASTM B 32 Solder Metal
   f. ASTM B 42 Seamless Copper Pipe, Standard Sizes
   g. ASTM B 43 Seamless Red Brass Pipe
   i. ASTM B 62 Cast Bronze Valves
   j. ASTM B 75 Seamless Copper Tube
   k. ASTM B 88 Seamless Copper Water Tube
   l. ASTM B 251 Wrought Seamless Copper and Copper-Alloy Tube
   m. ASTM B 302 Threadless Copper Pipe (TP)
   n. ASTM B 306 Copper Drainage Tube (DWV)
   o. ASTM B 447 Copper or Copper Alloy Tubing
   p. ASTM C 1540 Heavy duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
   q. ASTM C 564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
7. AMERICAN WELDING SOCIETY (AWS)
   a. ANSI/AWS A5.8 Brazing Filler Metal
8. AMERICAN WATER WORKS ASSOCIATIONS (AWWA)
   a. ANSI/AWWA C105/A21.5 Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
   b. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
   c. ANSI/AWWA C110/A21.10 Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids
   d. ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
   e. AWWA C506 Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types
   f. AWWA C651 Disinfecting Water Mains
9. CAST IRON SOIL PIPE INSTITUTE (CISPI)
   a. CISPI 301 Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems
   b. CISPI 310 Joints for Hubless Cast Iron Sanitary Systems
10. NATIONAL CERTIFIED PIPE WELDING BUREAU (NCPWB)
    a. NCPWB Procedure Specifications for Pipe Welding
11. NATIONAL FIRE PROTECTION ASSN (NFPA)
    a. NFPA 70 National Electrical Code
12. NATIONAL SANITATION FOUNDATION (NSF)
    a. NSF Std 5 Commercial Hot Water Generating and Heat Recovery Equipment
13. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
    a. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
14. PLUMBING AND DRAINAGE INSTITUTE (PDI)
    a. PDI WH-201 Water Hammer Arresters
15. UNDERWRITERS LABORATORIES (UL)
    a. UL 1453 Electric Booster and Commercial Storage Tank Water Heaters
    b. UL listed Product Directories

1.4 SUBMITTALS

A. Submit under provisions of Division 01, and Division 22, “Plumbing General Requirements” the following: manufacturer’s catalog data, installation, dimensions (including rough in dimensions) and operating and maintenance data for plumbing specialty items; catalog data and material certification for pipe materials and fittings. Provide for all items as listed in Specification Section 220110.

1.5 QUALITY ASSURANCE

A. Equipment of the same general type shall be of the same make.
B. Brand names and catalog numbers included with equipment or material specifications are used to indicate quality, rating or operating characteristics of the equipment of material.
C. All materials provided shall be new and shall be approved by the Underwriter’s Laboratories, Inc. wherever that agency has applicable standards. All work shall be accomplished in a neat, workmanlike manner by experienced journeymen. All work shall be performed at such times as are required by the progress of the job.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years’ experience.
B. Installer: NC State licensed plumber specializing in performing the work of this section with minimum 3 years’ experience.

1.7 REGULATORY REQUIREMENTS

A. Installation and materials shall be in conformance with the North Carolina State Building Code 2018 Edition (Year 2015 Edition of the International Plumbing Code as modified and adopted by the North Carolina Building Code Council).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 and Division 220110, Plumbing General Requirements.

1.9 SYSTEM COMPLETION

A. Provide all bolts, nuts, gaskets, sleeves, hangers, supports, miscellaneous valves and fittings, and specialties required for complete installation of the piping and equipment to be provided.

PART 2 - PRODUCTS

2.1 BURIED WASTE AND STORM DRAIN PIPING

A. Below grade: PVC DWV pipe and fittings: ASTM D 2665, Schedule 40, installation per manufacturer’s instructions, and connect by ASTM D 2564 PVC solvent cement. Use 2-inch minimum size underground.

2.2 ROOF DRAIN AND SANITARY DRAIN PIPING ABOVE GROUND

A. Cast iron pipe: All 1-1/2" through 8" cast iron soil, waste pipe and house or building sewer lines and fittings shall bear the registered insignia "CI" or "CI No-Hub" indicating that these items used in the sanitary system comply with the Cast Iron Soil Pipe Institute's Standard 301-63T. Universal "Alpha Couplings" or "No-Hub" stainless steel connections shall be used above grade.
B. Fixture Arms: Schedule 40 galvanized steel pipe with threaded fittings.

2.3 PUMPED WASTE PIPING

A. Above ground pumped waste piping 3" and smaller shall be ANSI/ASTM B88, Type "L" hard drawn copper, below ground shall be type "K" copper soft annealed without joints or hard drawn with brazed joints with filler metal conforming to AWS A5.8. The type, grade and manufacturer's name shall be indicated on each piece. Copper tubing which is out of round or kinked will not be acceptable. Fittings shall be wrought copper, ANSI B16.22, or cast brass, ANSI B16.18, with solder joints. Solder for potable water systems shall be lead free, 95 /5 Tin/Antimony. Joints on piping 2” and larger shall be silver brazed. Under no circumstances shall notching or mitering be permitted. Appropriate fittings shall be used for all turns, and joints.
B. Solder: 95-5 tin - antimony solder. Solders containing lead shall not be used on potable water systems.

2.4 WATER PIPING

A. All above grade water piping 3" and smaller shall be ANSI/ASTM B88, Type "L" copper, hard drawn, with the type and manufacturer's name on each piece. Fittings shall be wrought brass or copper. Under no circumstances shall notching or mitering be permitted. Appropriate fittings shall be used for all turns, and joints.
B. All above grade water piping 4” and larger shall be cement lined ductile iron with flanged joints.
C. All below grade water piping 3" and smaller shall be Type "K" copper soft annealed, with the type and manufacturer's name on each piece. Copper tubing which is out of round or kinked will not be acceptable on this project. Use as few joints as possible under the building slab. Where fittings are required under the building slab, provide wrought copper and connect by silver brazing.
D. Below grade water piping is also permitted to be cement lined ductile iron pipe meeting the requirements of ANSI-AWWA C151/A21.51-91, thickness class 50 or greater.
    1. Push-on joints shall be single rubber gasket push on type or mechanical joint type employing a single elongated rubber gasket to effect the joint seal and shall conform to ANSI A21.11 or AWWA C-111.
    2. Restrained pipe joints shall be push-on type with bolted retainer rings and welded retainer bars or the boltless type which includes ductile iron locking segments and rubber or neoprene retainers. Restrained pipe fittings shall be American Lok-ring, American Flex-ring, Griffin Snap-Lok, Clow Super-Lock, U.S. Pipe TR Flex, or approved equal.
    3. Cement lining shall be in accordance with ANSI A21.3 or AWWA C-104.
E. Fittings for copper pipe shall be wrought copper, ANSI B16.22, or cast brass, ANSI B16.18, with solder joints. Solder for potable water systems shall be lead free, 95 /5 Tin/Antimony. Joints on piping 1-1/2” and larger shall be silver brazed. Under no circumstances shall notching or mitering be permitted. Appropriate fittings shall be used for all turns, and joints.
F. Below Ground piping shall have a bituminous coating in accordance with ANSI A21.4 or AWWA C-104, Section 4-14. Avoid use of underground fittings. Where underground fittings are required, provide wrought copper and connect by silver brazing.
G. Solder: 95-5 tin - antimony solder. Solders containing lead shall not be used on potable water systems.

2.5 DIELECTRIC CONNECTORS

A. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Dielectric unions are not permitted.

2.6 ESCUTCHEONS

A. General: Use chrome-plated B & C Type 40 flush escutcheons on ceiling and wall. At floors, use Ritter No. 36-A deep cup chrome-plated escutcheon. Use Ritter, Grabler, Blaw-Knox, or equal. Escutcheons shall be used at all piping in finished areas. Escutcheons on insulated piping shall fit insulation tightly.

B. For Exposed Flush Valves, Water Supplies, and P-traps: Provide chrome-plated cast brass escutcheons with set screws.

2.7 FLASHING

A. Sheet lead for general use shall weigh at least 4 pounds per square foot. Sheet copper for general use shall weigh at least 12 ounces per square foot and conform to ASTM B152.

2.8 SLEEVES

A. Pipe Sleeves with Link Seal below grade: Modular mechanical type wall sleeve seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with pressure plate under each bolt head and nut. Tightening of the bolts shall cause the rubber links to expand and provide a positive weather tight seal between the pipe and the wall sleeve. Mechanical wall sleeve seals shall be “Link-Seal” model as manufactured by Thunderline Corporation, Wayne Michigan, Wade, Zurn, or equal.
B. Walls and Floors

1. Sleeves through poured through concrete walls and floors, and non-bearing partition walls shall be linear polyethylene as manufactured "Crete Sleeve", Sperzel Division, Tyler, or Charlotte Pipe.
2. Sleeves through waterproof floors or where exposed in rooms with floor drains shall be coated cast iron with flashing device and under deck clamp. J.R. Smith #1720, Josam, Wade or Zurn.
3. General Provision for Sleeves: Provide sleeves for all pipe passing through masonry fire walls, floors, foundation walls or ceilings of concrete or masonry construction, provide a Schedule 40 galvanized steel pipe large enough to clear pipes by 1/4 inch all around. No sheet metal sleeves are to be permitted. All floor sleeves shall extend 1/2 inch above floor. Sleeves at walls and ceilings shall be flush at wall lines. For insulated pipes, sleeves shall be larger than the outside diameter of the insulation and insulation shall be continuous through the sleeves. Sleeves shall be machine cut at right angles to centerline of pipe and deburred. No flame cut sleeves will be permitted.

2.9 CLEANOUTS

A. Cleanouts shall be adjustable and equipped with an internal brass plug with countersunk brass screws holding the rim to the body and cover. Provide tops with tile recess for floor coverings or terrazzo. Provide a permanent carpet indicator where cleanout is located under carpet. Line type shall have lacquered cast iron body and round epoxy coated gasketed cover. Wall cleanouts shall have stainless steel round access covers, frame with anchor lugs and cover plate with screws; as manufactured by Josam, or equal by Zurn, Jay R. Smith, or Wade.
B. Exterior cleanouts shall be brass recessed type protected by 24” x 24” x 6” thick concrete pad poured to finished grade.

2.10 WATER HAMMER ARRESTORS

A. ANSI A112.26.1; All stainless-steel construction, meets standards PDI WH-201 and ASSE 1010, filled with glycerin, pressurized with argon or nitrogen, size as indicated by PDI WH 201 letter designation; Series 75000-S as manufactured by Josam, or equal by J.R. Smith, Watts, or Zurn. Install where shown on the drawings.

2.11 BUTTERFLY VALVES

A. MSS SP-67: Butterfly Valves shall be lead free full-tapped lug design suitable for dead-end service. Valves through 6" shall have infinite position handles equipped with adjustable memory stops. Valves shall be suited for working pressure up to 150 psi and 275 F, shall have cast iron body, ductile iron discs, stainless

steel shaft, and elastomeric seats and o-rings. Provide with stem extension for insulated pipe applications.

2.12 ANGLE VALVES

A. Up to and including 2 Inches: Lead-free, MSS SP-80, Class 150, body and union bonnet of ASTM B 62 bronze, inside rising stem of bronze, brass packing gland, Teflon-impregnated packing, and malleable-iron handwheel.
B. Up to and including 2 Inches: Lead-free, Class 300, body and union bonnet of ASTM B 61 bronze, inside rising stem of bronze, plug disc and seat ring of stainless steel, and malleable-iron handwheel.
C. Over 2 inches: Lead-free Class 125, Iron body, MSS SP-85, bronze mounted with body and bonnet ASTM A 126, Class B cast iron, flanged ends, outside screw and yoke, with Teflon-impregnated packing and two-piece packing gland assembly, and malleable-iron handwheel.

2.13 CHECK VALVES

A. Up to and Including 2 Inches: Lead-free, Class 125 or Class 150, body and caps of ASTM B584-C89836 bronze, renewable bronze seat, threaded ends or solder ends, and swing type disc.

2.14 BALL VALVES

A. Up to and Including 4": Lead-free, 400 psig CWP, 150 psig SWP, bronze body, full port, adjustable packing gland, reinforced seats, blow-out-proof stem, inline repairable, chrome-plated brass ball, threaded, or soldered ends.
B. Provide with stem extension for insulated pipe applications.

2.15 STRAINERS

A. Size 2 Inches and Under: Lead-free, screwed bronze cast iron body for 175 psig working pressure, Y pattern with 1/32-inch perforated stainless-steel screen.
B. Each strainer with gate-type drain valve with 3/4-inch hose nipple and cap.

2.16 FLOOR DRAINS

A. ANSI A112.21.1, coated cast iron two-piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer. All floor drains shall have round tops, except where square tiles are employed provide square tops. Provide tractor grate, perforated stainless steel basket or sediment bucket, funnels, and trap primer connections where called for in the Plumbing Specialties Schedule.
B. Provide Series 30000 as manufactured by Josam, or equal by Zurn, Jay R. Smith, or Wade.
C. Use deep seal p-traps with all floor drains.

2.17 VACUUM BREAKERS

A. Atmospheric type – bronze body and trim with 212F temperature rating, 125 PSI working pressure, bottom inlet, side outlet, and silicone sealing disc. Provide polished chrome finish where exposed in finished areas.

2.18 TRAP SEAL PRIMERS

A. TP-1: Flush valve type with vacuum breaker, Model FVP-1VB as manufactured by Precision Plumbing Products, or approved equal by Sloan, Delta, or Zurn. All exposed parts to be chrome plated. The Flush Valve Primer replaces the standard flush valve connection providing a fresh water prime to replenish the floor drain trap seal. Each time the flush valve operates, approximately 3 ozs. of water flows through the

priming tube to the floor drain trap. The flush valve primer is designed to prime one floor drain trap at a distance not to exceed twenty (20) feet from point of installation. The flush valve primer shall come with vacuum breaker ports.

2.19 THERMOSTATIC MIXING VALVES

A. Thermostatic mixing valves shall meet ASSE 1070 requirements and be listed by NSF. Provide Models listed in the Plumbing Fixture Schedule manufactured by Bradley or approved equal by Haws, Leonard Water Temperature Controls, Watts, or equal.

2.20 SUMP PUMP

A. Engineered submersible cast iron or stainless steel sump pump and control package which allows water to be automatically pumped from elevator pits in accordance with ASME A17.1.
B. Local audio / visual and remote electronic warning systems for:
   1. High liquid condition
C. Provide a submersible sump pump rated per the schedule on the drawings. The pump shall be designed to pump dirty or semi-dirty waters containing 3/8" spherical solids without damage during operation. The pump shall be designed so that the pump shaft horsepower (BHP) shall not exceed motor-rated horsepower throughout the entire operating range of the pump performance curve. Pump shall be built to operate whether fully or partially submerged.
E. Motor: The pump motor shall be hermetically sealed, submersible type, fractional HP, single phase, split phase or permanent split capacitor, oil cooled and lubricated with internal automatic resetting thermal overload protection.
F. Motor Cable: Pump motor cable shall be suitable for submersible pump applications. Cable shall have required length of UL/CSA approved "water resistant" #16 AWG cord.
G. Control: Automatic type with integral level control. Controller shall be hard wired to an electrical circuit.
H. Float Switch: A mechanical, non-mercury float switch or diaphragm level switch shall be provided for automatic operation.
I. Sump Pump Controller: Provide Weil Simplex Pump Control Panel Model 8110 (or approved equal by other pump manufacturer if another manufacturer's pump is used) which shall alarm for high water conditions. Include a set of dry contacts to communicate alarm conditions to the BAS.
J. Manufacturer: Pump shall be by Weil Pump Co. (basis of design), Stancor Inc., Ebara International Corporation, Grundfos Pumps Corp., Little Giant Pump Co., Flygt Pump, Vertiflo Pump Company, or Zoeller Co.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.3 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever joining dissimilar metals. Protect insulating material if heat is applied to fitting.
C. Route piping in orderly manner. Grade piping to low points and provide drain valves.
D. Install piping to conserve building space and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Provide Sleeves for all pipes passing through floors, walls and ceilings, of sufficient size to receive insulation and of proper length to terminate 1" outside finished surfaces. Pipe sleeves shall be caulked with non-hardening caulking to prevent transmission of noise between floors and walls.
H. Pipe Penetrations through fire partition walls and through floors shall be made by UL penetration detail as indicated with caulking with UL listed fireproof caulking.
I. Provide clearance for installation of insulation and access to valves and fittings.
J. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with those specified in Division 05.
K. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover, except where noted otherwise.
L. Piping buried under slab within building shall be installed with a minimum of joints and shall be completely encased in sand.
M. Changes in pipe sizes shall be made with reducing fittings.
N. Make copper piping joints for 1-1/4” pipe and smaller with 95-5 solder, and no corrosive solder paste. Flux and solder combinations are not permitted. Make copper piping joints for 1-1/2” to 3” with silver brazing.
O. Provide domestic water branch piping to fixtures and make final connections to fixtures provided by this or other contractors.
P. Do not rough piping inside spaces, partitions, stud wall voids, plenums, or cavities subject to potential freezing.
Q. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
R. Provide escutcheons for piping passing into finished areas. All uninsulated piping in finished areas shall be chrome plated.
S. Hangers supports and threaded rods shall be furnished galvanized, except where attached to copper pipe. Clamps or other attachments on copper piping shall be copper or copper plated steel.
T. Prepare pipe and accessories not prefinished, ready for finish painting. Refer to Division 09 and Section 220553.
U. Excavate in accordance with Section 220510 for work of this Section.
V. Backfill in accordance with Section 220510 for work of this Section. All underground lines shall be marked as follows. Provide warning tape or tracer wire in the backfill of all pipe trenches. Install at least 6 inches below grade, but not deeper than 24 inches below grade, directly over piping.
    1. Metallic lines shall be identified with durable printed plastic warning tapes, minimum 3 inches wide with lettering to identify buried line below.
    2. Non-metallic pipes shall be marked using an approved tracer. A yellow insulated copper tracer wire or other approved conductor shall be installed adjacent to and over the full length of underground nonmetallic piping. Access shall be provided to the tracer wire or the tracer wire shall terminate at the cleanout between the building drain and the building sewer. The tracer wire size shall not be less than 14 awg and the insulation shall be listed for direct burial.
W. Install bell and spigot pipe with bell end upstream.
X. Provide valves at inlet and outlet of each piece of equipment, at each fixture, on branch lines and where indicated on the drawings.
Y. Install valves with stems upright or horizontal, not inverted.
Z. Install all devices in accordance with manufacturer's instructions.
AA. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system. Encase exterior cleanouts and valve boxes in concrete flush with grade.

BB. Install water hammer arrestors complete with accessible isolation valve on hot and cold-water supply piping to lavatories, sinks, and water closet flush valves.

3.4 SUMP PUMP INSTALLATION

A. Install in accordance with manufacturer's written instructions.
B. Provide line sized isolating valve and line sized soft seated check valve on discharge.
C. Support piping adjacent to pump such that no weight is carried on pump casings.
D. Verify operation of automatic float control and pump by adding water to the sump pit and allowing the pump to remove it.

3.5 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.
B. Install unions downstream of valves and at equipment or apparatus connections.
C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
D. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
E. Install ball valves for throttling, bypass, or manual flow control services.

3.6 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/8 or ¼ inch per foot, as required. Maintain gradients. Slope water piping and arrange to drain at low points.

3.7 PLUMBING SYSTEM TESTING

A. Water: Upon completion of a section of, or entire water distribution system, the system, or portion completed, shall be tested and proved tight under a water or an air test of not less than 100 psi. This pressure shall be held for not less than 15 minutes.
B. Waste and Vent: A water test shall be applied to the drainage system within the building either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. When testing in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10-foot head of water. In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost 10 feet of the system, shall have been submitted to a test of less than a 10-foot head of water. This pressure shall be held for not less than 15 minutes. The system shall then be tight at all points.

3.8 POTABLE WATER SYSTEM STERILIZATION

A. All pipe and fittings connected to and forming a part of a potable water supply shall be sterilized. Sterilization shall be accomplished after the pipe has passed the hydrostatic pressure tests. The method used by the contractor shall be in full accordance with the requirements of the AWWA Specification C-601, and state and local Departments of Health.
B. All new piping shall be filled with not less than 25, nor more than 50 parts per million (ppm) of available chlorine and held in contact with such for not less than 24 hours. Final tests after 24 hours shall show minimum residual chlorine content of 25 ppm in all parts of the system. All chlorine introduced into the system shall be totally dissolved. The introduction of solid hypochlorite directly into the system is prohibited.
C. Sterilization tests shall be repeated as often as necessary and as directed by the engineer and/or Department of Health, until the minimum residual chlorine content has been maintained. The chlorine solution shall be thoroughly flushed prior to placing the new sections of piping in service. The contractor

is cautioned that the spent chlorine solution must be disposed of in such as way as not to be detrimental to plant, animal of aquatic life.

D. After disinfection, the water system shall not be placed in service until bacteriological test results of representative water samples analyzed in an independent, EPA approved laboratory, are found to be satisfactory. Certification of bacteriological testing for quality of the domestic water shall be conducted, accepted by the Project Engineer prior to requesting Beneficial or Final Occupancy Permit.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
   1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 22 specification sections, Division 21, Division 23, Division 26, and Division 31 specifications apply to work of this section.

B. Section 22 01 10 - Plumbing General Requirements

C. Section 22 10 00 - Plumbing Piping and Specialties

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation.
   1. Air conditioning and refrigeration institute (ARI)
      a. ANSI/ARI 1010 Drinking Fountains and Self-Contained, Mechanically Refrigerated Drinking Water Coolers.
   2. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
      a. ANSI/ASME A112.6.1M Supports for Off-the-Floor Plumbing Fixtures for Public
      b. ANSI/ASME A112.18.1M Plumbing Fixture Fittings
      c. ANSI/ASME A112.19.2M Vitreous China Plumbing Fixtures
      d. ANSI/ASME A112.19.3M Stainless Steel Plumbing Fixtures (Designed for Residential Use)
      e. ANSI/ASME A112.19.5 Trim for Water Closet Bowls, Tanks, and Urinals
      f. ANSI/ASME A112.19.6 Hydraulic performance Requirements for Water closets and Urinals
   3. AMERICAN SOCIETY OF SANITARY ENGINEERS (ASSE)
      a. ASSE 1037 Pressurized Flushing Devices Flushometers) for Plumbing Fixtures

1.3 Submit under provisions of Division 01 and Division 22 “Plumbing General Requirements”: listing of plumbing fixtures, including manufacturer’s catalog data, installation instructions, dimensions including rough-in dimensions, pipe connection sizes, trim, and finishes. Provide certification from Manufacturer that lead based solders were not used in fabrication of electric water coolers or fountains. No fixtures shall be delivered to the building until the Engineer has inspected and approved the complete listing of fixtures.

1.4 Perform Work in accordance with the current State of North Carolina Building Code (International Plumbing Code as modified by the NC Code Council).

1.5 Deliver products to site, store, protect, and handle under provisions of Division 01. Accept fixtures on site in factory packaging. Inspect for damage. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.6 Verify that the field measurements are consistent with the dimensions as indicated on approved shop drawings. Confirm that millwork is constructed with adequate provision for the installation of countertop fixtures.

PART 2 - PRODUCTS

2.1 Unless specifically indicated otherwise, each plumbing fixture shall be provided with a trap, waste, and water fittings with connections as indicated, each plumbing fixture shall be provided complete for the specified function (including water inlet(s) and waste outlet(s)), and except for stainless steel fixtures, the fixture color shall be white. Use the same manufacturer for each grouping of faucets, valves, flush valves, etc. for the entire building.

2.2 Vitreous china plumbing fixtures, ASME 112.19.2M, shall be thoroughly fused so that a fractured surface shall show a homogeneous mass, free from pores and with close grain. Glaze shall cover all surfaces that are exposed when the fixture is installed in its normal manner. Vitreous china fixture manufacturers shall be American Standard, Eljer, Kohler, Toto, Sloan, or Crane.

2.3 Exposed piping, trimming and fittings shall be chromium or nickel-plated brass with polished surfaces. Floor and wall plates shall be chromium plated brass.

2.4 Fixtures, faucets, flush valves and other trim shall contain ≤ 0.25% total lead content by weighted average.

2.5 FLUSHOMETER TYPE WATER CLOSETS

A. Flushometer Type Water Closets, ANSI/ASME A112.19.2M, white vitreous china, floor mounted, or wall mounted as scheduled, siphon jet, 1-1/2" top spud, elongated bowl with white, solid, plastic, elongated open-front seat, and ANSI A112.19.5 trim. The inside of water closet bowl trapways shall be glazed.
B. Flush valves shall be manually operated, exposed type and furnished with integral stop valve, vacuum breaker and flush pipe. The water flushing volume of the flushometer and water closet combination shall not exceed 1.6 gallons per flush. Valve body, cover, tailpiece and control stop shall be in conformance with the applicable sections of ASSE 1037 and ANSI/ASME 112.19.2. The flush valve shall be capable of operation without chattering or water hammer, at any inlet pressure from 25 to 80 psi. Provide straight or angle type stop as required to suit flush valve.
    1. Finish: Polished Chrome.
    2. Piston: Self-cleaning brass piston with integral wiper spring to prevent clogging.
    3. Spud Coupling: 1-1/2" with wall and spud flanges for top spud connection, cast set wall flange with set screw.
    4. Supply Pipe: 1" with 1" I.P.S. angle stop, and vandal resistant cap.
    5. Handle: ADA compliant metal oscillating non-hold-open handle, with no external volume adjustment. Handle packing, stop seat and vacuum breaker molded from chloramine resistant material.
C. Handicapped Water Closets and trim shall be specified by the manufacturer to compliance with the ADA. The top of the seat of the handicapped toilet for adults shall be 17" to 19" above finished floor.
D. Water Closet Manufacturers: American Standard, Sloan, and Toto.
E. Flush Valve Manufacturer: American Standard, Sloan, and Zurn.

2.7 LAVATORIES – VITREOUS CHINA

A. Lavatory: ADA compliant, wall hung, white vitreous china, rear overflow, recessed self-draining deck, chrome plated grid drain, American Standard Decorum Model 9134004EC, or equivalent by Kohler, Crane, Eljer, or Sloan. Provide carriers recommended by lavatory manufacturer to support these lavatories.
B. Provide commercial grade ANSI/ASME A112.18.1/CSA B125.1, and ADA compliant faucet of cast brass construction with a polished chrome finish, manually operated, single lever handle, 0.5 gpm, aerated spray, three hole deck-mounted, diamond coated ceramic cartridge. Provide perforated grid strainers, and 1-1/4-inch adjustable chrome plated cast brass P traps with ground joint and cleanout plug. Tubular trap shall have a wall thickness of at least 17 gauge.
    1. Manufacturer: Delta Model 500-DST, or approved equal by American Standard or T&S Brass.

PART 3 - EXECUTION

3.1 WATER CLOSET INSTALLATION

A. Cover supply pipe extending from wall with chrome plated sleeve and wall flange.
B. Provide additional wall plates where each pipe extends through finished wall.
C. Install centerline of the flush valve on the centerline of the fixture, and a minimum of 2-1/4 inches from the wall. Manual flush valve handles for handicap fixtures shall be mounted on the wide side of the toilet area and no more than 36 inches above the floor. All other flush valve handles shall be mounted 39 inches above the finished floor.
D. Provide chrome-plated pipe support on the long flush pipe outlet and secure rigidly to the wall with suitable anchors.
E. Install backflow preventer for the flush valve at the discharge of the valves.
F. Rigidly support flush valve water piping concealed in the partition; provide piping between flush valve and wall with a factory- fabricated chromium-plated spacer sleeve and wall flange.
G. Provide vertical adjustable carrier to support wall hung water closet.

3.2 LAVATORY INSTALLATION

A. Install lavatories for use by wheelchair handicapped adults with a rim height between 34 and 36 inches, a minimum vertical knee clearance of 27 inches from floor, and a minimum clear knee recess of 30 inches in width. Knee clearance shall be 11 inches minimum in depth at 9 inches above the floor, and 8” minimum in depth at 27 inches above the floor. Refer to architectural drawings for guidance.
B. Install trap on lavatory for use by wheelchair handicapped so as to provide maximum clearance under bowl. Insulate exposed waste, trap and hot water supply under lavatory in accordance with the requirements for domestic hot water piping.

3.3 SETTING COMPOUNDS AND GASKETS

A. Provide watertight and gas tight seals between flanges and fixtures with plumbing-fixture-setting compound. In sealing connections, use neither rubber gaskets nor putty. Seal watertight all voids between the flange and the floor below the fixture with plumbing-fixture-setting compound or other approved sealing material.

3.4 OUTLET FLANGES AND ENDS OF SOIL PIPES

A. Provide outlet flanges and ends of soil pipes set the correct distance from the face of the floor or wall to make a joint with the gasket and fixture. Obtain approval for the setting of the flange prior to setting any fixture in place.

3.5 WATER SUPPLY BRANCH PIPING

A. Provide all exposed water supply branch piping (including valves and fittings) not more than 6 feet above the floor in toilet rooms and all piping below lavatories finished and chromium-plated.
B. Do not bury water pipe in floor construction of any toilet room.
C. Where water piping is not sized on the drawings, comply with the sizing requirements of the National Standard Plumbing Code.
D. Provide each hot and cold-water supply to each lavatory with a ball or angle valve or compression stop in an accessible location near the fixture.
E. Do not use stop cocks in lieu of valves.
F. Run risers and drops supplying toilet rooms in chases, furred spaces, or shafts where possible.

3.6 FIXTURE HEIGHTS

A. Water Closet for Physically Handicapped Persons: 17 to 19 inches to top of seating surface. The flush valve handle shall be located on the “wide side” of the stall or room.
B. Lavatory for Physically Handicapped Persons: Refer to paragraph 3.2.

3.7 SILICONE SEALANT

A. Provide a bead of 100% white silicone sealant between the top and side edges of each water closet, lavatory, and the wall to which it is adjacent.

3.8 SPARE PARTS

A. Provide 1 spare cartridge kit for lavatory faucets.
B. Provide a minimum of one set of special tools required to remove vandal-proof items to the owner.
C. These spare parts shall be turned over to the Owner within 30 days of final acceptance. The contractor shall obtain a signed receipt from the Owner which details what was turned over and the date it was turned over. A copy of this receipt shall be included in the project closeout documentation.

END OF SECTION

SECTION 22 48 00

WATER HEATING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
   1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections and other Division 22 specification sections, Division 23, Division 26, and Division 31 specifications apply to work of this section.
B. Section 220110 - Plumbing General Requirements
C. Section 220150 - Basic Materials and Methods
D. Section 220700- Plumbing Insulation
E. Section 224000 - Plumbing Fixtures

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
   1. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
      a. ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
      b. ANSI B16.23 Cast Copper Alloy Solder-Joint Pressure Fittings - DWV
      c. ANSI B31.9 Building Services Piping Code
   2. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR- CONDITIONING ENGINEERS (ASHRAE)
      a. ANSI/ASHRAE 90.1B Energy Conservation in New Building Design
   3. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
      a. ANSI/ASME Code Boiler Pressure Vessel Code
      b. ANSI/ASME Code Sec.9 Boiler and Pressure Vessel Code -Welding and Brazing Qualifications
      c. ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
      d. ANSI/ASME B16.3 Malleable-Iron Threaded Fittings, Classes 150 and 300
      e. ANSI/ASME B16.4 Cast-Iron Threaded Fittings Class 125 and 250
      f. ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
      g. ANSI/ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes
      h. ANSI/ASME B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
      i. ANSI/ASME B16.32 Cast Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems
   4. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
      a. ASTM A 47 Ferritic Malleable Iron Castings
      b. ASTM A 53 Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
      c. ASTM A 74; CIS{O 3-1, Cast Iron Soil Pipe and Fittings ASTM A888
      d. ASTM A 234/A234M Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
      e. ASTM B 32 Solder Metal
      f. ASTM B 42 Seamless Copper Pipe, Standard Sizes
      g. ASTM B 43 Seamless Red Brass Pipe
      i. ASTM B 62 Cast Bronze Valves

j. ASTM B 75 Seamless Copper Tube
k. ASTM B 88 Seamless Copper Water Tube
l. ASTM B 302 Threadless Copper Pipe (TP)
m. ASTM B 447 Copper or Copper Alloy Tubing

5. AMERICAN WELDING SOCIETY (AWS)
   a. ANSI/AWS A5.8 Brazing Filler Metal
6. NATIONAL CERTIFIED PIPE WELDING BUREAU (NCPWB)
   a. NCPWB Procedure Specifications for Pipe Welding
7. NATIONAL FIRE PROTECTION ASSN (NFPA)
   a. NFPA 70 National Electrical Code
8. NATIONAL SANITATION FOUNDATION (NSF)
   a. NSF Std 5 Commercial Hot Water Generating and Heat Recovery Equipment
9. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
   a. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
10. UNDERWRITERS LABORATORIES (UL)
    a. UL 1453 Electric Booster and Commercial Storage Tank Water Heaters
    b. UL listed Product Directories

1.3 SUBMITTALS

A. Submit under provisions of Division 01, and Division 22, “Plumbing General Requirements” the following: manufacturer’s catalog data, installation, dimensions (including rough in dimensions) and operating and maintenance data for plumbing specialty items; catalog data and material certification for pipe materials and fittings. Provide for all items as listed in Specification Section 220110.

1.4 QUALITY ASSURANCE

A. Equipment of the same general type shall be of the same make.
B. Brand names and catalog numbers included with equipment or material specifications are used to indicate quality, rating or operating characteristics of the equipment of material.
C. All materials provided shall be new and shall be approved by the Underwriter’s Laboratories, Inc. or by ETL. All work shall be accomplished in a neat, workmanlike manner by experienced journeymen. All work shall be performed at such times as are required by the progress of the job.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years’ experience.
B. Installer: NC State licensed plumber specializing in performing the work of this section with minimum 3 years’ experience.

1.6 REGULATORY REQUIREMENTS

A. Installation and materials shall be in conformance with the North Carolina State Building Code 2018 Edition (Year 2015 Edition of the International Plumbing Code as modified and adopted by the North Carolina Building Code Council).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 and Division 220110, Plumbing General Requirements.

1.8 SYSTEM COMPLETION

A. Provide all bolts, nuts, gaskets, sleeves, hangers, supports, miscellaneous valves and fittings, and specialties required for complete installation of the piping and equipment to be provided.

PART 2 - PRODUCTS

2.1 TANKLESS ELECTRIC WATER HEATER

A. Provide automatic, electrically heated, thermostatically controlled, tankless point-of-use handwashing water heater.
B. Manufacturers: Stiebel Eltron Model Mini™-E 2-1, or approved equal by A.O. Smith, Eemax, or Rheem.
C. Glass-fiber reinforced heating chamber resistant to liming, flow switch control to avoid dry-fire, with a safety high-limit switch with manual reset.
D. Thermostatic electronic control with adjustable outlet temperature from 86-122°F. Minimum flow to activate: 0.21 gpm. Water volume in unit of 0.026 gal.
E. Minimum pressure of 30 psi, working pressure of 150 psi, and tested to 300 psi.
F. 120V, single phase, 1.8 kW, amperage draw 15A, energy factor of 0.97(UEF).
G. Heater shall have 10 years leakage and 3 years parts limited warranty.

PART 3 - EXECUTION

0.1 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever joining dissimilar metals. Protect insulating material if heat is applied to fitting.
C. Route piping in orderly manner. Grade piping to low points and provide drain valves.
D. Install piping to conserve building space and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Provide Sleeves for all pipes passing through floors, walls and ceilings, of sufficient size to receive insulation and of proper length to terminate 1" outside finished surfaces. Pipe sleeves shall be caulked with non-hardening caulking to prevent transmission of noise between floors and walls.
H. Provide clearance for installation of insulation and access to valves and fittings.
I. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with those specified in Division 05.
J. Changes in pipe sizes shall be made with reducing fittings.
K. Make copper piping joints with 95-5 solder, and no corrosive solder paste. Flux and solder combinations are not permitted.
L. Provide valves at inlet and outlet of each piece of equipment, at each fixture, on branch lines and where indicated on the drawings.
M. Install valves with stems upright or horizontal, not inverted.
N. Install unions downstream of valves and at equipment or apparatus connections.
O. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
P. Install ball valves for shut-off and to isolate equipment, part of systems, vertical risers, throttling, bypass, or manual flow control services.

0.4 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/8 or 1/4 inch per foot, as required. Maintain gradients. Slope water piping and arrange to drain at low points.

B. **END OF SECTION**

SECTION 230510

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 REFERENCES & INTENT

A. All work of this Division shall comply with the requirements of the Drawings, General Conditions, Supplementary General Conditions and Division 01 Specifications section.
B. Study all drawings and specifications before submitting bids.
C. Work under this Division includes all essential labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items for proper installation and operation of all systems even though not specifically mentioned or indicated.
D. Drawings are diagrammatic. Drawings are not intended to be absolutely precise and do not specify or show every offset, fitting, and component. The purpose of the drawings is to indicate a system concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the contractor shall provide all other components and materials necessary to make the systems fully complete and operational. Contractor shall route piping or provide offsets to avoid interference with structural elements, equipment, electrical panels and junction boxes, etc. Verify locations, dimensions, flow directions, etc. before construction.
E. It is the intent of these specifications and drawings to provide for finished systems of the quality specified, properly tested, balanced and ready for operation. This includes all devices and accessories required to make the work complete even though such items may not be expressly shown or specified. Drawings and specifications are complementary and must be so construed to determine the full scope of work.
F. Brand names and catalog numbers included with equipment or materials specifications are used to indicate quality, rating, or operating characteristics of the equipment or material.
G. Jobsite Conditions. The Contractor shall visit the site and familiarize himself with the existing conditions before submitting his bid. Failure to do so does not relieve the Contractor from completing the work as specified herein and after. Requests for additional payments due to the Contractor's failure to allow for work conditions will be rejected.

1.2 WORK INCLUDED

A. The following work is specifically included without limiting the generality implied by these specifications and drawings.
   1. All mechanical scope of work specified herein and as shown on the plans. Contractor should review all drawings and include all items that are a part of his scope.
   2. All associated wiring, cutting and patching.
B. Bidders shall examine equipment plans and specifications and include in their bids all labor and material required for complete installation and connection of equipment which is properly a part of their trade even if it is not provided in the equipment specifications.

1.3 STANDARDS AND CODES

A. All equipment with electrical components shall bear the UL label.
B. Standards by the following organizations shall be complied with wherever applicable:
   1. ANSI American National Standards
   2. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
   3. ASTM American Society for Testing Material
   4. NEC National Electric Code
   5. NEMA National Electrical Manufacturers Association
   6. NFPA National Fire Protection Association

7. OSHA Occupational Safety and Health Act
8. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.
9. North Carolina State Building Code
10. Any Other Applicable local and State Codes

C. In the event there are conflicts between specifications and standards or codes, standards or codes shall govern unless specifications are in excess of standards.

1.5 PERMITS AND FEE

A. Make application for all necessary permits and pay applicable fees.

1.6 STRUCTURAL STEEL AND CONCRETE

A. Structural members may not be pierced without prior written approval of the Engineer.

1.7 WATERPROOFING

A. Waterproofed floors and walls may not be cut.

1.8 WORK SCHEDULE:

A. Work schedule shall be in accordance with Division 01.
B. The existing facilities shall remain in use during construction under this Contract. The Contractor shall cooperate with the Owner in every way possible to keep interruption of, and interference with, normal functions, activities, and operations to a minimum. Where construction or attendant work interrupts normal functions in any area, a schedule of work shall be submitted for approval of the Owner and after approval, strictly followed. Modification to existing work shall be done as required. All work shall be performed in such a manner as to prevent any interruption of any service or utility. Where it is necessary to interrupt service for cut-in or changeover, the work shall be scheduled well in advance of the interruption and the interruption approved by the Owner. If required by Owner, changeover work shall be done during night, weekends, holidays, or other off-peak period as approved. Existing piping, ductwork, etc., shall be modified as indicated on the drawings and/or as required by new and modified construction. Existing piping, ductwork, etc., modified as required, shall be put in first class operating condition. Existing equipment, piping, and sheet metal work to be removed shall become the property of the Contractor and be removed from the site and disposed of in a legal means unless otherwise indicated. No equipment shall be disconnected without approval by the Engineer. Existing piping buried in building construction shall be left in place and capped behind new finish. All temporary relocation of equipment, temporary piping, sheet metal work, etc. required for temporary operation of the facility shall be provided.
C. Any demolition or installation work producing excessive dust or noise deemed to be disruptive or possibly unsafe to building operations must be, at the Owner’s discretion, performed after normal working hours.

1.9 PROTECTION OF EQUIPMENT

A. Provide all necessary protection and be fully responsible for material and equipment stored or installed on the site. Material or equipment stolen or damaged shall be replaced at no additional cost to the Owner.
B. Provide protection against theft, physical damage and the entry of dirt, water or corrosive fumes into the material and equipment. Maintain protective covers for the duration of construction. Store equipment, such as controls, subject to damage by moisture and temperature extremes in a dry, heated space.

1.10 FIRE SAFETY

A. Fire Watch: Provide a fire watch wherever welding, brazing, cutting, or other processes involving an open flame or potential for generating sparks is used. Fire watch shall consist of a person with a 10-pound carbon

dioxide fire extinguisher. While on fire watch, the person so assigned shall have no other duties or assignments.

B. Fire Blanket: In addition to providing a fire watch, use an approved fire blanket to cover any combustible materials in the immediate area.

C. Burn Permit: For all cutting, burning and welding operations a burn permit is required. This permit may be obtained from the Owner at no cost.

1.11 GUARANTEES

A. Furnish written guarantee in accordance with requirements of General Conditions. Partial approval of a portion of work does not affect the validity of guarantee.

1.12 SHOP DRAWINGS

A. It shall be noted that shop drawing submittals processed by the Engineer are not change orders; that the purpose of shop drawing submittals is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use. If deviations, discrepancies or conflicts between shop drawing submittals and the contract documents in the form of design drawing and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. The Engineer may also require the contractor to submit samples of proposed or specified equipment for approval with the samples to be returned to the contractor upon request. During the submittal process, if the contractor submits equipment which is not EXACTLY like the equipment specified, the contractor shall provide a list of those differences to the engineer for his review and approval. If the contractor's list is incomplete, and the submittal is approved, the approval does not waive the differences that were not submitted for review.

B. The design documents indicate the products that were used as the basis of design. This establishes the product parameters and other systems interacting with the product (size, power requirements, pipe sizes, pump capacity, etc.) The contractor shall specifically bring to the designer’s attention any changes in other systems required when products other than those used as the basis of design, are used. The contractor shall bear all costs, including design, for the changes.

C. Prior to procurement or manufacturing, submit for approval appropriate shop drawings and/or descriptive literature giving performance data, physical size, wiring diagrams, configuration, capacity, material, etc., for all items under this Division including the following:
   1. Exhaust Fans
   2. Condensate Drain Pipe and Pipe Fittings
   3. Supports, Anchors, and Vibration Isolation
   4. Mechanical Identification
   5. Insulation
   6. Air Outlets and Inlets
   7. Ductwork and Dampers
   8. Ductless Split Systems
   9. Refrigerant Piping and Specialties
   10. Testing and Balancing
   11. Instrumentation
   12. Electric motors, disconnects, or other electrical components not included in other submittals

D. The contractor shall visit the site and familiarize himself with the project requirements and the field conditions before preparing shop drawings and ordering equipment. Field verify the characteristics of all specified or existing equipment before preparing shop drawings. This shall include available space, available voltages, suitability of substrate for receiving the specified equipment, etc. Where existing equipment is re-used, he shall verify dimensions, capacities, horsepower, etc. and bring any discrepancies to the attention of the Engineer.

E. Where different products have to work together, it is the Contractor’s responsibility to select manufacturers whose products are visually and/or technically compatible.

F. Prepare listing of all equipment and materials for the project. A sample schedule is included at the end of this section to complete this requirement. Provide all information represented.
G. Submittals of shop drawings and manufacturer's data, etc. shall be provided to the Designers electronically in PDF format. The Designer will review the submittals and return them electronically. The exception would be color samples or other material that cannot be adequately represented electronically, and these should be submitted as five (5) hard copies. The Designer will review them and return three (3) copies.

1.13 RECORD DOCUMENTS

A. During construction, keep an accurate record of all changes and deviations from contract documents. Upon completion of this installation, the contractor shall submit to the Designer maintenance manuals and colored scans of the marked-up prints in PDF format indicating any installed work that is different from what is shown on the drawings.

PART 2 – PRODUCTS

2.1 QUALITY OF MATERIAL

A. Equipment of the same general type shall be of the same make. Reference is made to relays, motors, valves, motor starters, contactors, etc.
B. Brand names and catalog numbers included with equipment or material specifications are used to indicate quality, rating or operating characteristics of the equipment or material.
C. All materials provided shall be new and shall be approved and labeled by the Underwriter's Laboratories, Inc., or other accredited third-party agency, wherever such agency has applicable standards. All work shall be accomplished in a neat, workmanlike manner by experienced journeymen. All work shall be performed at such times as are required by the progress of the job.
D. All components, equipment and systems shall comply with the latest edition adopted by the State of North Carolina of ASHRAE 90.1, ASHRAE 62.1, ASHRAE 15 and any other applicable ASHRAE standard.

PART 3 - EXECUTION

3.1 CLEARANCE AND RESTORATION OF SITE

A. It may be required to temporarily remove existing ceiling tiles, piping, duct, conduits, etc. to introduce new work as specified in this Division. Contractor, after installation of new work, shall reinstall, reconnect removed items to match the existing. Provide offsets if required in existing piping, ducts etc. to introduce new work.

3.2 RATED ASSEMBLIES

A. Installation of any equipment shall not compromise fire ratings of rated assemblies. All penetrations shall be sealed per UL guidelines for penetration protections. Provide fire dampers or combination fire and smoke dampers where required by code.

3.3 COORDINATION

A. Install all work to permit removal of equipment without damage to the equipment or the building. Verify equipment space requirements, condition of substrate, voltages, etc. at the time of shop drawing submission and advise the Engineer of any conflict.
B. Coordinate equipment locations as well as piping and conduit routing with Owner's representative to optimize all present and foreseen future space usage and clearance requirements.
C. Do not rough prior to receipt of approved shop drawings.

3.4 EQUIPMENT INSTALLATION AND SUPPORT

A. Install all equipment where indicated, in accordance with manufacturer's published installation instructions, and with recognized industry practices to ensure that equipment complies with requirements and serves intended purposes. Consult with Engineer if said instructions or practices conflict with the drawings/specifications.
B. The manufacturer's installation instructions shall be available on the job site at the time of inspection and start-up as required by NC Mechanical Code 304.1.
C. Support plumb, rigid and true to line all work and equipment furnished under this Division. Study thoroughly architectural, mechanical drawings and all related drawings to determine how equipment, piping, ductwork, etc., are to be supported, mounted or suspended. Provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper support as required whether or not shown on drawings. When directed, furnish for approval a drawing showing supports.
D. Any system component which may require maintenance, such as control valves, manual valves, strainers, etc. shall not be installed over electrical equipment, machinery, control panels or floor openings.

3.5 FINAL ADJUSTMENT AND TESTING

A. General - Provide all testing, preliminary and final adjustment of instrumentation for this purpose. Conduct all tests in full compliance with applicable codes prior to covering or concealing work by insulation, enclosures, etc. Material found to be defective shall not be repaired. It shall be replaced with new material which tests satisfactorily. Defective workmanship shall be corrected.
B. Working Tests - Subject all equipment and controls to simultaneous and continuous working tests for a period of one day prior to final inspection. Make adjustments, repairs and equipment replacements as required.

3.6 LABELS, IDENTIFICATION AND TAGS

A. All components or equipment shall be identified using permanent engraved nameplates, permanently attached with pin-head screws to device or to wall or mounting panel above device. Stick-on type labels will not be acceptable.
B. Label and identify all piping installed under this contract. Install plastic pipe markers or stenciling after finish painting has been completed.
C. Refer to Section 23 05 90 – Mechanical Painting and Identification.

3.7 OWNER'S RIGHT TO TEST SYSTEMS

A. Should, in the opinion of the Engineer, and during the guarantee period, reasonable doubt exists as to the proper functioning of any equipment installed under this Contract, the right is reserved for the Owner and Engineer to perform any test deemed practical to determine whether such equipment is functioning properly and performing at required capacity. If such tests show proper functioning, the cost of the test will be paid by the Owner. If the tests indicate a deficiency in equipment capacity or performance, the Contractor shall pay the cost of the test and also make good any deficiencies shown by the test to the full satisfaction of the Owner and the Engineer.

3.8 CLEANING UP

A. The contractors performing work under this section shall at all times keep the premises and the building in a neat and orderly condition and any instructions of the Engineer in regard to the storing of material, protective measures, cleaning up of debris, etc. shall be explicitly followed. At the completion of the job, all equipment shall be cleaned to the satisfaction of the Owner.

3.9 INSPECTION CERTIFICATES

A. Obtain all inspections required by law, ordinances, rules, and regulations of the Authorities having jurisdiction and obtain and furnish to the Engineer certificates of such inspections, pay all fees, charges, and other expenses in connection therewith.

3.10 DESIGNER INSPECTIONS

A. The designer will make regular site visits during construction and will keep a deficiency log of all observed exceptions. The contractor shall resolve these noted deficiencies as expediently as possible.

3.11 FINAL REVIEW

A. Final review and tests of the completed construction shall be performed in the presence of the Engineer or his representative and shall be at such times as are convenient to the Engineer. Final tests shall show conclusively that all equipment performs its specified function and that all work complies with the provisions of these specifications. All material, equipment, and instruments required for the tests shall be furnished by the Contractor at his own expense.

3.12 EQUIPMENT DELIVERY AND PROTECTION

A. All material shall be delivered and unloaded by the Contractor within the project site as directed by the Owner.
B. The Contractor shall protect all material and equipment from breakage, theft or weather damage.

3.13 OPERATING INSTRUCTIONS

A. The Contractor shall provide a minimum of four (4) hours of personal instruction to Owner's personnel in the proper operation of all equipment specified and provided. The instruction shall be provided by factory trained and certified competent personnel. The instruction shall include but not be limited to the following:
   1. Instructions for the operation of the rooftop units, air terminal units, fans, ductless split systems, and DDC controls.
B. If off-site instruction is required, the contractor shall include in his bid the cost of boarding, lodging and transportation of three people from Durham to the training site. The cost shall also include all costs during the training period.

3.14 MAINTENANCE MANUALS

A. Maintenance Manuals shall be submitted in three (3) hard copies in vinyl 3-ring binders, and three (3) copies in electronic format as PDF files on disks. Each manual shall have the following:
   1. Service telephone number of the installing company, including an emergency number.
   2. Contact person, phone number, and address of manufacturer or distributor where equipment was purchased.
   3. The manufacturing company's operating and maintenance manuals for each piece of equipment.
   4. Copies of all approved shop drawings.
   5. Copies of warrantees with their start dates.
B. Furnish for each building permanent type charts, framed under clear plastic, mounted in at least one mechanical room on each floor or where directed as follows:
   1. Service organizations with day and night telephone numbers.

PRODUCTS LISTING FORM

INSTRUCTIONS:

Do not use the terminology "as specified"; rather indicate specifically the product proposed.

Prepared by: _____

_____

Date: _____ Project:

SPEC. SECTION	ITEM	MANUFACTURER

END OF SECTION

SECTION 230529

SUPPORTS, ANCHORS AND VIBRATION ISOLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections and other Division 23 specification sections.

1.2 QUALITY ASSURANCE:

A. Codes and Standards:
1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of supports and anchors.
2. UL and FM Compliance: Provide products which are UL-listed and FM approved where required.
3. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS) Standard Compliance:
a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
b. Select and apply pipe hangers and supports, complying with MSS SP-69.
c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
d. Terminology used in this section is defined in MSS SP-90.
e. Acceptable Manufacturers: Vibration Mountings and Controls, Inc., Grinnell, Modern, Mason Industries, Metraflex, or approved equal.

1.3 SUBMITTALS:

A. Manufacturer's Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory- fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide galvanized hangers, rods, support assemblies, connectors, etc., except provide copper-plated hangers and supports for copper-piping systems.
B. Adjustable Steel Clevis Hangers: MSS Type 1.
C. Yoke Type Pipe Clamps: MSS Type 2.
D. Steel Double Bolt Pipe Clamps: MSS Type 3.
E. Steel Pipe Clamps: MSS Type 4.
F. Adjustable Swivel Pipe Rings: MSS Type 6.
G. Adjustable Steel Band Hangers: MSS Type 7.
H. Adjustable Band Hangers: MSS Type 9.
I. Adjustable Swivel Rings, Band Type: MSS Type 10.
J. Split Pipe Rings: MSS Type 11.
K. Extension Split Pipe Clamps: MSS Type 12.

L. U-Bolts: MSS Type 24.
M. Clips: MSS Type 26.
N. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
   1. Plate: Unguided type.
   2. Plate: Guided type.
   3. Plate: Hold-down clamp type.
O. Pipe Saddle Supports: MSS Type 36, including steel pipe base- support and cast-iron floor flange.
P. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
Q. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.
R. Single Pipe Rolls: MSS Type 41.
S. Adjustable Roller Hangers: MSS Type 43.
T. Pipe Roll Stands: MSS Type 44.
U. Adjustable Pipe Roll Stands: MSS Type 46.

2.2 VERTICAL-PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
B. Two-Bolt Riser Clamps: MSS Type 8.
C. Four-Bolt Riser Clamps: MSS Type 42.

2.3 HANGER-RODS AND ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide galvanized steel hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
B. Steel Turnbuckles: MSS Type 13.
C. Swivel Turnbuckles: MSS Type 15.
D. Malleable Iron Sockets: MSS Type 16.

2.4 BUILDING ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
B. Concrete Inserts: MSS Type 18.
C. Rod Attachment Concrete Plate
D. Channel Clamps: MSS Type 20.
E. Welded Beam Attachments: MSS Type 22.
F. C-Clamps: MSS Type 23.

2.5 SADDLES AND SHIELDS:

A. General: Except as otherwise indicated, provide saddles and shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.6 MISCELLANEOUS MATERIALS:

A. Metal Framing: Provide products complying with NEMA STD ML 1.
B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

2.7 VIBRATION ISOLATION:

A. General: Provide vibration isolation where indicated in the plans. Equipment isolation shall be as designed and submitted by the equipment manufacturer.
B. Equipment shall be isolated from the structure by means of resilient vibration and noise isolating supports. Supports shall be such that vibration is isolated and expansion and contraction is accommodated without creating excessive stresses in piping or equipment connections.
   1. All isolators shall be designed or treated for resistance to corrosion. Steel components shall be PVC coated, or phosphated and painted with industrial grade 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. A finish coat of industrial enamel shall be applied over the primer. All isolators exposed to the weather shall have steel parts PVC coated, hot-dipped galvanized or zinc-electroplated plus coating of neoprene or bitumastic paint. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel. Nuts, bolts and washers may be zinc-electroplated.
   2. Isolators shall be installed in such a manner that loaded deflections are compensated for initially.
C. Vibration bases and/or isolators shall be provided for motors and motor-driven equipment, where indicated on the drawings.
D. Isolator Elements: Steel springs shall be open or housed type as specified with static deflection required and the capability of 30% over travel before becoming solid. Springs shall be designed for lateral stability with a stiffness ratio of 1 except where greater horizontal thrust required greater horizontal stiffness.
E. Elastomers shall be rubber, neoprene, Buna N, silicone or other material to meet specific service conditions and shall be molded in the range of 30 to 60 durometers. Material shall be of color coded stock for easy identification of rated load capacity.
F. Precompressed fiber glass shall consist of a high-density matrix of molded glass fiber encased in a waterproof neoprene jacket resistant to oil, acids and fungus and color coded for easy identification of rated load capacity.
G. Isolator Types: Isolators shall be applied in accordance with the "types", as follows, where Type I isolators shall be utilized for centrifugal refrigeration machines installed on or below grade; Type II isolators shall be utilized with mounted equipment of 3 HP or less (unless otherwise specified); Type III isolators shall be utilized with mounted equipment of 5 HP or larger (unless otherwise specified); and Type IV isolators shall be utilized for all suspended pipe and equipment:
   1. Type I - Pad type mountings consisting of any one of the following constructions:
      a. Two layers of ribbed or waffled neoprene pads bonded to a 16-gauge galvanized steel separator plate. Bolting not required. Pads shall be sized for approximately 20 to 40 psi load, or a deflection of 0.12 inch to 0.16 inch.
      b. Precompressed fiberglass properly sized for 5 to 60 psi loading depending on density with steel plates bonded to top of isolator.
      c. Two layers of ribbed or waffled neoprene pads bonded to vibration cork sized for 10 to 60 psi loading.
   2. Type II - Elastomeric mountings having steel baseplate with mounting holes and a threaded insert at top of the mounting for attaching equipment. All metal parts shall be completely embedded in the elastomeric material. Mountings shall be designed for approximately 1/4-inch deflection and loaded so that deflection does not exceed 15% of the free height of the mounting.

3. Type III - Adjustable, freestanding, open-spring mountings with combination leveling bolt and equipment fastening bolt. Spring (or springs) shall be rigidly attached to mounting base plate and to the spring compression plate. A neoprene pad having a minimum thickness of 1/4 inch shall be bonded to the baseplate.
4. Type IV - Spring hangers for isolation of noise and vibration consisting of a rectangular steel box, elastomeric element, coil spring, spring cups, neoprene impregnated fabric washer, and steel washer. The design shall be such as to prevent metal-to-metal contact between the hanger rod and the top of the hanger box. The elastomeric element shall meet the design requirements for Type II mountings. The hanger box shall be capable of supporting a load of 200% of rated load with- out noticeable deformation or failure. For piping, provide combination spring and double deflection low dynamic stiffness hangers, same or equal to Mason Industries 30N.

H. Piping Isolation: Flexible connectors in piping at equipment mounted on vibration isolators shall allow for movement between pipe and equipment. Flexible connectors shall have flanged or screwed ends to match pipe size of line. If screwed ends are used, flanges or unions must be installed to allow for removal of units.
1. Rubber Construction: Single sphere neoprene rubber, large change in diameter, consisting of multiple plys of Kevlar tire cord and EPDM, rated at 225 internal pressure, with captive flanged connections. Provide as manufactured by Keflex, Metraflex, or Mason Industries.
2. Stainless Steel Construction and shall be as made by Keflex or equivalent by Flex Hose or Minnnesota Flex. Units shall be designed for no less than 125 psi pressure and have a maximum operating temperature of 450 degrees F. Each unit shall be of the proper length to accept the movement involved and be fitted with a braided jacket.

I. Duct Isolation: Flexible EPDM connectors between duct at equipment mounted on vibration isolators shall allow for movement between duct and equipment. Flexible connectors shall be weather sealed with gasketed ends to make connection to unit flange and duct.

J. Roof Equipment Rails: Prefabricated roof equipment rails to be manufactured of prime galvanized steel construction of 16 gauge material, meeting ASTM A653/653M. Heights to be 12" above finished roof deck or as noted on the drawings or schedules. Top of all roof equipment rails shall be level, with pitch built into the rail when deck slopes.

2.8 PIPE SUPPORTS ON ROOF:

A. Support piping on the roof with Model 1.5 Pillow Block Supports by Miro Industries, Inc., B-Line Dura-Blok Rooftop Supports by Cooper Industries, Model MT-1-A8 Single Post Rooftop Pipe Supports by MAPA Products, or approved equal.

2.9 EQUIPMENT MOUNTING SUPPORTS ON ROOF:

A. Support outdoor heat pump or condensing units on the roof on prefabricated equipment mounting supports. These shall consist of a factory fabricated 18-gauge galvanized steel shell, base plate, and counterflashing, with factory installed wood nailer, internal bulkhead reinforcement, and all welded construction. Provide Model TEMS-3 by Thybar Corporation, or similar by Curbs Plus Inc., Roof Products Inc., Roof Products & Systems Corporation, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure with maximum loading as shown below. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Provide all facia boards, cleats, brackets, backing in partitions, toggle bolts, expansion shields, screws, clamps and rods, etc., for hanging of all piping and equipment included under this Division.

C. Hangers and braces shall adequately support the piping system horizontally and vertically and shall allow for expansion and contraction without binding in sleeves or misalignment. Provide for expansion of piping with swing joints and ample sleeves.

D. Vertical Piping: Supports for vertical piping 1-1/2 inches and smaller from wall with malleable split ring hanger. Nipples cut to fit each case. Two hangers per floor minimum. Use clamps on every floor for pipes 2 inches and larger. In crawl spaces, support stacks on base fitting placed securely on concrete piers or masonry blocks and with pipe clamps.

E. Horizontal piping shall be supported with hangers as follows:

STEEL PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1 inch	3/8 inch	7 feet
1-1/4” inches	3/8 inch	8 feet
1-1/2 inches	3/8 inch	9 feet
2 inches	3/8 inch	10 feet
2-1/2 inches	1/2 inch	11 feet
3 inches. & 3-1/2 inches.	1/2 inch	12 feet
4 inches and 5 inches	5/8 inch	14 feet
6 inches	7/8 inch	17 feet
8 inches	7/8 inch	19 feet
10 inches	7/8 inch	20 feet
12 inches	7/8 inch	23 feet

COPPER TUBE SIZE	ROD DIAMETER	MAXIMUM SPACING
½ & ¾ inch	3/8 inch	5 feet
1 inch	3/8 inch	6 feet
1-1/4 inch	3/8 inch	7 feet
1-1/2 inches	3/8 inch	8 feet
2 inches	3/8 inch	8 feet
2-1/2 inches	1/2 inch	9 feet
3 inches & 4 inches	1/2 inch	10 feet

F. Load carrying capacities of threaded steel rod based on allowable stress of 12,000 psi.

ROD SIZE - INCHES:	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
ALLOW LOAD - LBS:	610	1130	1810	2710	3770	4960	6230	8000

G. Generally, pipes shall be individually supported. Trapeze hangers may be used where approved. Piping shall be individually bolted to trapeze with U bolts.

H. Piping Along Wall - From approved wall brackets fastened to wall with Phillips anchors or inserts. Installation - Provide pipe bars, angles, etc. as required. Anchor piping to localize expansion and prevent undue strain on piping and branches. Provide spring type hangers for vibration isolation where shown on plans and as specified in vibration isolation section.

I. Locate hanger not more than 4 feet from elbow or tee on screwed piping. Space hangers on 3-foot center on horizontal piping 1-1/2 inch and smaller exposed at corridor ceilings and less than 8 feet from floor in finished rooms.

J. Support from Concrete Construction - All main piping runs shall be supported from hangers secured to cast-in-place concrete inserts. Branch piping hanger supports may be field drilled using self-drilling type expansion shields equal to Phillips concrete fasteners or approved equal. Expansion shields shall not cut or unduly displace reinforcement.

K. Support from Precast Concrete - Use toggle bolts mounted in core sections of precast concrete. Absolutely no ramset or any other power driven fasteners will be allowed in precast planks.

L. Support from Existing Concrete - Piping may be attached to the structure using power driven fasteners. All fasteners into concrete shall penetrate the slab for a distance equal to 6 to 8 times the diameter of the shank. Power driven fasteners will not be used in concrete encased steel beams.
M. Test drill existing concrete to ensure rebar is not cut or damaged when installing anchors.
N. Support from Structural Steel - Make use of existing steel members for pipe support. Provide additional structural steel members where required to accommodate hangers.
O. Anchors - Anchor piping as shown or required to isolate expansion and prevent pipe strain due to expansion. Anchors shall be separate from other supports.
P. Expansion Joints and Pipe Guides – Install in accordance with manufacturers recommendation. Locate additional guide within recommended distance of the first guide integral to the expansion joint.
Q. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
R. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

3.2 INSTALLATION OF ROOF EQUIPMENT RAILS

A. Roof equipment rails shall be furnished by the mechanical contractor and installed by the general contractor.

3.3 PROVISIONS FOR MOVEMENT:

A. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
B. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3.4 EQUIPMENT SUPPORTS:

A. Provide concrete housekeeping bases for all floor-mounted equipment furnished or relocated as part of the work of Division 23. Unless otherwise noted, size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners. Provide concrete bases and pads where required in compliance with section 23 05 45 of these specifications.
B. Provide structural steel Stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands. Provide shop drawings for structural steel stands for Engineer's approval.

3.5 GALVANIZING:

A. All hangers, supports, and connections shall be galvanized coated.

END OF SECTION

SECTION 230530

ELECTRICAL PROVISIONS FOR MECHANICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
   1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections, other Division 23 specification sections, and Division 26 Sections apply to work of this section.

B. This section is a Division 23 Basic Mechanical section and is a part of each Division 23 section referring to electrical provisions of Mechanical work specified within.

1.2 DESCRIPTION OF WORK

A. Extent of electrical provisions to be provided as mechanical work is indicated in other Division 23 sections, on drawings, and as further specified in this section.

B. All work on this project will be done through a single prime contract. All power and control wiring and other electrical work shown is the responsibility of the prime contractor. These include but are not necessarily limited to the following:
   1. Motors for mechanical equipment.
   2. Starters for motors of mechanical equipment whether or not starter is specifically indicated to be furnished with the mechanical equipment. Unless otherwise noted, the mechanical contractor shall provide all motor starters, and combination starters/disconnects required for mechanical equipment. Motors being equipped with adjustable speed drives (ASD's) will not require starters. The mechanical contractor shall provide the ASD's.
   3. All electrical equipment and devices (panels, disconnects, circuit breakers, etc.).
   4. All interlock and control wiring required for sequence of operation of mechanical devices provided for mechanical systems.
   5. All power wiring for mechanical equipment and all power and low voltage wiring for the DDC controls.
   6. Any power wiring required for mechanical equipment not specifically shown on electrical drawings or specified in Division 26.
   7. Duct smoke detectors, if provided per NFPA 90A requirements, shall be furnished and wired by Division 26, installed by Division 23. Fire alarm AHU shut down circuits shall be wired from the fire alarm control panel to a termination point, adjacent to the AHU control, under Division 26. AHU control wiring from the termination point to the equipment shall be under Division 23.

C. Refer to other Division-23 sections for specific individual mechanical equipment electrical requirements.

D. Refer to Division-26 sections for any electrical equipment not included in this section and for materials and methods of other electrical components.

1.3 QUALITY ASSURANCE

A. Coordination with Electrical Work: Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections. Comply with applicable requirements of Division 26 sections for electrical work of this section which is not otherwise specified.

B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements. Electrical work shall be done in accordance with Codes listed and also requirements of Division 26.

1.4 SUBMITTALS

A. Listing, Motors of Mechanical Work: Concurrently with submittal of mechanical products listing (Basic Mechanical requirements), submit separate listing showing rating, power characteristics, application (connected equipment), and general location of every motor to be provided with mechanical work. Submit updated information promptly when and if initial data is revised.
B. Include in listing of motors, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motor.
C. Product Data of Motor Control Equipment
D. Product Data of Motor Safety Disconnect Equipment.
E. Product Data of ASD Cables

PART 2 - PRODUCTS

2.1 MOTORS

A. Manufacturer: Except where item of mechanical equipment (which otherwise complies with requirements) must be integrally equipped with motor produced by another manufacturer, provide motors for mechanical equipment manufactured by one of the following:
   1. Baldor Electric Co.
   2. General Electric Co.
   3. Reliance Electric Co.
   4. U.S. Electric Motor Co.
B. Motor Characteristics: Except where more stringent requirements are indicated, and except where required mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work:
   1. Temperature Rating: Rated for 40 deg.C environment with maximum 50 deg.C temperature rise for continuous duty at full load. Insulation shall be Class F.
   2. Starting Capability: Provide each motor capable of making starts as frequently as necessary by automatic control system, and not less than 5 starts per hour for manually controlled motors.
C. Phases and Current Characteristics: Unless otherwise noted, provide squirrel-cage induction polyphase motors for 1/2 hp and larger, and provide capacitor-start single-phase motors for 1/3 hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Unless otherwise noted all polyphase motors shall be suitable for 240-volt, 3 phase, 60 Hz service.
D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
E. Motor Construction: Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque. For motors controlled by variable speed drives, provide inverter duty motors that comply with NEMA MG1-Part 3 Definite Purpose Inverter-Fed Motors.
F. Frames: NEMA No. 56 or Type T(unless otherwise noted)
G. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance.
H. Motor shaft grounding: Provide low impedance shaft grounding rings and brushes for ASD controlled motors as a path for induced shaft currents.
I. Where belt drives and other drives produce lateral or axial thrust, in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
J. Enclosure Type: Except as otherwise indicated, provide TEFC motors. Refer to individual sections of Division 23 for other enclosure requirements.
K. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
L. Noise Rating: Provide "Quiet" rating on motors.
M. Efficiency: All permanently wired motors of 1 HP or more shall have a nominal full load motor efficiency not less than that required by ASHRAE 90.1. Unless otherwise specified, provide premium efficiency motors.

N. Name Plate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

2.2 EQUIPMENT FABRICATION

A. General: Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and OSHA compliant removable guards for motor drives, arranged for lubrication and similar running-maintenance without removal of guards.

2.3 MOTOR STARTERS

A. Manufacturers: Subject to compliance with requirements, provide motor starters of one of the following (for each type and rating of motor starter):
   1. Eaton Corp.
   2. General Electric Co.
   3. Square D Co.
   4. Siemens
B. General: Except as otherwise indicated, provide motor starters and ancillary components which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation.
C. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
D. Motor Starter Characteristics:
   1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.
   2. Manual switches shall have pilot lights and extra positions for multi-speed motors.
   3. Overload protection: Electronic solid state overload relays with integral phase loss protection.
E. Magnetic Starters:
   1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
   2. Trip-free thermal overload relays, each phase.
   3. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of mechanical equipment. Multi-Speed starters shall be provided with integral time delay transition between "FAST" and "SLOW" speeds.
   4. Built-in control circuit transformer, fused online and load side to match coil voltages of controls elements. Train wiring to maintain separation of line, load and controls voltage conductors.
   5. Externally operated manual reset.
   6. Under-voltage release or protection.
F. Motor Connections: Liquid-tight flexible conduit not to exceed 4’-0” in length, except where plug-in electrical cords are specifically indicated.
G. Combination Non-Reversing Starters: Provide full voltage alternating-current combination non-reversing starters, consisting of starter and disconnect switch mounted in common enclosure, of types, sizes, ratings, and NEMA sizes as required. Equip starters with electrical interlocks for interfacing with other starters. Equip starters with block type manual reset overload relays and with circuit breakers or non-fusible disconnect switches.
H. Provide ground bus bars or double-barrel ground lugs to maintain low impedance ground path from motor.
I. Provide operating handle for disconnect mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being padlocked in OFF position. Construct and mount starters and disconnect switches in single NEMA Type 1 enclosure: coat with manufacturer's standard color finish.
J. AC Fractional HP Manual Starters: Provide single-phase fractional HP manual motor starters, of sizes and ratings required. Equip with manually operated quick-make, quick-break toggle mechanisms; and with

one-piece melting alloy type thermal units. Starter to become inoperative when thermal unit is removed. Provide starters with double break silver alloy contacts, visible from both sides of starter; green pilot lights and switch capable of being padlocked OFF. Enclose starter unit in NEMA Type 1 general purpose enclosure suitable for flush mounting; coat with manufacturer's standard color finish.

2.4 WIRING

A. Wiring shall be 600 volt rated thermoplastic insulated listed for the use and conditions they are installed in.
B. Low voltage wiring shall be AWG no. 16 or larger as needed to accommodate voltage drop , color coded wire or cable. Line voltage wiring shall be not smaller than no. 12 AWG. All wire shall be run in rigid conduit with outlet boxes and fittings in a manner specified in the electrical specifications. All ground wire shall be insulated green run inside raceway system with current carrying conductors. All wire shall be pulled to every pump, disconnect, starter motor etc. Conduit shall not be used as ground.
C. All raceway, wiring and electrical installations shall comply with Division 26.

2.5 DISCONNECTS

A. Non Fused.
   1. Wall mounted, standard duty, single throw in NEMA-l enclosure or NEMA 3R enclosure, weatherproof for exterior locations. Single pole or three pole as required with insulated solid neutral double-barrel lug/bar and bonded ground double-barrel lug/bar. External handle lockable in the open position. Disconnect switches shall be provided wherever the code requires local disconnecting means.
   2. Make - Square D, EATON, General Electric or Siemens.
B. Fused Disconnect Switches
   1. Fused disconnect switches shall be used only where fuse ratings are established on equipment nameplates in lieu of MOCP ratings. Use enclosed circuit breakers where possible.
   2. Single throw, quick-make, quick-break Number of poles as required by load. NEMA-1 general purpose enclosure indoors in dry locations, NEMA 3R weatherproof enclosure outside. Standard fuse clips, lockable in open position. Rating 250 or 600 VAC as required.
   3. Accessories: Provide a shield and a strap for removing the fuse.
   4. Make - Square D, EATON, General Electric or Siemens.

2.6 MOLDED CASE CIRCUIT BREAKERS (MCCB)

A. Manufacturers: Subject to compliance with requirements, provide MCCB's of one of the following:
   1. EATON Corp.
   2. General Electric
   3. Siemens
   4. Square D
B. General: MCCB's shall be industrial grade (bolt-on) with ratings and special features as scheduled on drawings. Trips shall be thermal magnetic with inverse time delay and instantaneous time-current characteristics. 225 ampere frame and larger MCCB's shall have interchangeable trips and adjustable magnetic feature. MCCB's used outdoors shall have ambient compensating trips. MCCB's used for switching lights shall be rated for switching duty and shall be so labeled. MCCB's used for overcurrent protection for HVAC equipment shall be rated "HACR" type and shall be so labeled. MCCB's to be installed in existing panelboards shall be of the same manufacturer as the panelboard and listed for the use.
C. Ganged use of single-pole breakers for multi-pole applications is not acceptable.

2.7 ENLOSED CIRCUIT BREAKERS (ECB)

A. Manufacturers: Subject to compliance with requirements, provide ECB's of one of the following:
   1. EATON Corp.
   2. General Electric
   3. Siemens

4. Square D

B. General: ECB's shall be used where possible for motor and mechanical equipment disconnect switches. Fused disconnect switches shall only be used where fuse ratings and no MOCP ratings are shown on the nameplate.
C. ECB ratings shall be per NEC and manufacturer's documentation, in that order where conflicts may exist.
D. Ganged use of single-pole breakers for multi-pole applications is not acceptable.

2.8 ADJUSTABLE SPEED DRIVES

A. Refer to Section 230571 Adjustable Speed Drives.
B. Wiring between Adjustable speed drives and motors shall be ASD rated premanufactured cable with twisted motor leads in raceway to reduce EMF.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
B. Install motor starters, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to ensure that products fulfill requirements.
C. Coordinate with other work including motor and electrical wiring/cabling work, as necessary to interface installation of motor starters with other work.
D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.

3.2 ADJUSTING AND CLEANING

A. Inspect electrical starter's operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.
B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL

A. Subsequent to connecting wires/cables, energize motor starter circuitry and demonstrate functioning of equipment in accordance with requirements; where necessary correct malfunctioning units, phase rotation at the motor to maintain distribution system phase color sequence and then retest to demonstrate compliance.

END OF SECTION

SECTION 230590

MECHANICAL PAINTING AND IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 23 specification sections, apply to work of this section.

1.2 SCOPE

A. Paint and/or identify the following:
   1. All mechanical equipment.
   2. All electrical equipment, including panels and disconnects.
   3. Thermostat box for EF-2.

1.3 SUBMITTALS:

A. Manufacturer's Data: Submit manufacturer's technical product data and installation instructions.

PART 2 - PRODUCTS

2.1 ENGRAVED PLASTIC-LAMINATE SIGNS AND EQUIPMENT MARKERS:

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes indicated, 1/16" thick, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
B. Fasteners: Self-tapping stainless steel screws.

PART 3 - EXECUTION

3.1 PAINTING:

A. All equipment, except where otherwise specifically noted, shall be furnished in prime coat. All uninsulated black steel piping shall be prime coated and finish painted in light gray unless otherwise required by schedule below to be color coded. All welds, on both insulated and uninsulated piping, shall be painted with one coat of primer. All miscellaneous black steel items such as hangers and rods, machinery supports, breechings and stacks, etc., shall be prime coated and finish painted in light gray. Exposed surfaces of insulation shall be sealed. All metal surfaces shall be thoroughly cleaned of rust and dirt and shall be degreased before application of primer. All prime coated equipment shall be touched up where prime coats are chipped, scratched, or otherwise damaged. All prime coated equipment shall be thoroughly cleaned and left ready for finish painting. Where cast iron accessories or galvanized pipe, or equipment surfaces are to receive finish painting, the item shall be properly primed.
B. Ferrous surfaces shall be painted with the following coats:
   1 coat of primer equivalent to Bruning Silathane 520-14 grey-green primer, Benjamin Moore 06- 20 red oxide alkyd primer or Richards SR-1399 red metal primer.
   2 coats of finish equivalent to Bruning Silathane Gloss Enamel 520-32 quarry gray, Benjamin Moore Gloss Enamel 22-38 or Richards Gloss Enamel 1003 Series.
C. Finish painting of all equipment and piping (both insulated and uninsulated) shall be provided. Where indicated or specified, existing equipment, piping, duct, etc. shall be cleaned and painted along with new

work. Do not paint piping that is provided with aluminum or PVC jacketing insulation covering. Paint piping insulation per color schedule below and provide stenciled identification or plastic pipe markers.

1. Painting and/or identification shall be in accordance with the following schedule:

ITEM	IDENTIFICATION	PIPE COLOR
Natural Gas	NAT. GAS	Yellow

D. All other uninsulated ferrous pipes shall be painted light gray with stenciled identification as specified under stenciling.

E. The interiors of ductwork visible through grilles, registers, diffusers, or other duct openings, and/or interiors that can reflect light shall be painted flat black, except do not paint fire or smoke dampers.

3.2 GENERAL MECHANICAL IDENTIFICATION:

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting.

3.3 MECHANICAL EQUIPMENT IDENTIFICATION:

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. IDUs and ODUs
   2. Exhaust Fans
   3. Thermostat for EF-2
   4. Disconnects

END OF SECTION

SECTION 230594

TESTING AND BALANCING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and Standard General Conditions of the Construction Contract, including Supplementary General Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Testing and Balancing Agency (TAB) shall be selected and hired by the general contractor or mechanical contractor and shall be certified by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). The Agency shall show proof of having successfully completed at least five projects of equal size and scope within the previous three years and shall have on its staff a full-time Professional Engineer registered in the State of North Carolina.
B. Immediately after the award of a contract, the contractor shall perform a Design Review of the mechanical plans and specifications. He shall identify any omissions or discrepancies that will preclude the proper balancing of the systems and report same to the Construction Manager in a formal report.
C. Test and balance HVAC air systems as shown and specified on the schedules and Contract Documents and make submittals as described in this Section.

1.3 SUBMITTALS - Submit the following to the Owner's Representative for approval:

A. Inspection reports (prior to and during testing and balancing).
B. Other tests, records, certifications and reports as specified in this Section.
C. Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) Certification
D. List of instruments actually used for each test. Include instrument calibration dates.
E. TAB report including preliminary and final balance data sheets) (see Paragraph 3.05). Also submit to Engineer for record.

1.4 REFERENCE STANDARDS

A. Unless shown or specified otherwise, the TAB work shall comply with the following:
   1. AABC National Standards or National Environmental Balancing Bureau (NEBB) Standards for Field measurements and Instrumentation.
   2. ASHRAE 110-1985: Method of Testing Performance of Laboratory Fume Hoods.
   3. HVAC Systems Testing, Adjusting, and Balancing, Sheet Metal & Air Conditioning Contractor's National Association, Inc. (SMACNA), 1993.

1.5 QUALITY ASSURANCE

A. The organization performing the TAB work shall be certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).
B. The work shall be performed by regular employees specifically trained in the total balancing of air systems. The work shall be continuously conducted under the direct supervision of a Professional Engineer registered in the State of North Carolina who is a certified Test and Balance Engineer by AABC or NEBB and is experienced in testing and balancing of HVAC systems.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Adjust, test and confirm air flow rates, pressure drops, pressures, temperature and heat transfer performance of HVAC system, including split system heat pump system and exhaust air systems, including all associated fans, dampers, terminal devices, and performing accessories.
B. Provide preliminary and final (2 phases) testing and balancing. Initiate preliminary testing and balancing immediately after certification of fan (before controls, ceilings, walls, etc. are completed). Confirm macro level performance of devices. The preliminary phase shall be followed by a submitted written report of system shortcomings which prohibit final balancing. Following preliminary testing and balancing, if balancing or control devices are not operating correctly, report these conditions to the Owner's Representative, who shall coordinate required corrections so that balancing can continue.
C. Perform the work using methods and test forms published by AABC National Standards for Field Measurements and Instrumentation (No. 71679, 2nd edition or any later edition) or corresponding NEBB methods and forms.
D. Do not start final testing and balancing until each system has been certified to be complete.
E. Using controls and devices installed, test and balance air conditioning systems with maximum attainable internal load (lights and equipment), or simulated maximum load using automatic temperature controls, whichever is closest to design operating conditions.
F. Do the final testing and balancing of air handling systems with finished ceilings and partitions in place and doors closed.
G. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
H. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation. Minimize use of balancing devices to "throttle" flow. When balanced, all volume control devices in the path to the terminal with the highest-pressure drop shall be fully open.
M. Have on the job site the AABC or the National Environmental Balancing Bureau (NEBB) standards referred to herein and make them available to the Mechanical Contractor and the Owner's Representative.
N. The Owner's Representative shall be given the opportunity to witness final testing and balancing of all system. The Testing and Balancing Contractor shall notify the Owner's Representative ten (10) working days prior to each system being tested and/or balanced.
O. Repair or replacement of finished products damaged as a result of testing, balancing and inspection work shall be the responsibility of the Contractor.

3.2 INSTRUMENT CALIBRATION

A. Provide written certification of the accuracy of all instruments furnished or used for Testing and Balancing. Show date and method of calibration. All instruments shall have been calibrated within six (6) months prior to the estimated completion date of balancing work.
B. Verify the accuracy of permanently installed flow-measuring primary elements and their read-out instruments, thermometers, sensors and pressure gauges furnished under this contract. Verification may be by calculation and calibration of the primary element and read-out instrument, or by an independent measurement of the flow, temperature or pressure of the flow, of the same flowing medium using calibrated instruments. Submit a report of certification, verification, or inaccuracy of all calibrations.

3.3 BALANCING PROCEDURES AND RELATED WORK

A. Balancing shall achieve design air, within a tolerance of -5% to +10% on major equipment (AHU's, Fans) and +/- 10% at terminal points (air outlets, inlets, transfer air quantities, etc.).

B. Verify that all thermostats and other controls and the devices they control (such as dampers and fans) operate as they are intended and, in the sequence, specified. Report device failures in bi-weekly reports.
C. Where indicated on drawings and/or schedules, constant volume terminal boxes shall have associated manual volume dampers adjusted such that, when terminal box is indexed to its highest cfm position, the terminal box automatic damper will be in its wide-open position.
D. Where solid-state variable speed controls have been provided, adjust and mark controls for proper setting to produce the design flow.
E. Protect read-out instruments from damage and return them in good working order to the Mechanical Contractor.
F. Only direct-flow measurement may be used. Do not use indirect calculations, such as a heat balance or pressure drop in a heat exchanger.
G. Provide required openings for duct traverses. Seal test holes in ducts with snap-in plugs. In addition, plugs shall be airtight type and/or sealed airtight in 1% and dust collection leak class systems. Tape is not permitted. Repair insulation where damaged. Mark insulation where readings were taken.
H. Record the test data for each motor, fan, air system, and heat pump. Apply temperature, barometric and other correction factors for non-standard conditions and record in report.

3.4 TEST AND RECORDS

A. Submit a separate test report for each air system outlining actual temperatures, pressure drops and flow rates at all terminal devices (e.g., intake louver, air terminals, etc.) And compare totals to the flow measurements taken at the source (e.g., fans) and to the design parameters.
B. In addition, record test data where applicable on the following test forms defined in Chapter 26 of the AABC National Standards or corresponding NEBB forms.
    1. Air Moving Equipment Test Sheet - Form No. 82030.
    2. Exhaust Fan Data Sheet - Form No. 82031.
    3. Duct Traverse Readings - Form No. 82035.
    4. Duct Traverse Readings - Form No. 82036.
    5. Air Distribution Test Sheet – Form No. 82040.
    6. Air Cooled Condenser - Form No. 82081.
    7. Cooling Coil Data - Form No. 82100.
    8. Heating Coil Data - Form No. 82101.
C. In addition to data required on National Environmental Balancing Bureau (NEBB) or AABC forms, the following additional information is required for all scheduled equipment:
    1. Motors - Type, frame, number, serial number, and calculated brake horsepower and efficiency at final condition.

3.5 TESTING AND BALANCING REPORTS

A. Submit preliminary and final testing and balancing reports for approval.
B. Arrange recorded data by system, using the appropriate designations as established in the Contract Documents. Submit six signed, bound and indexed copies of both preliminary and final reports per building to the Owner’s Representative.
C. Where actual measurements recorded for the final balance show deviation of more than the specified tolerance from the design, and the deviation cannot be corrected by balancing with the installed layout and elements, note this deviation in the final report with recommendations for corrective action.
D. In those cases where recorded data can be reasonably interpreted to be inaccurate, inconsistent or erroneous, the Owner’s Representative may request additional testing and balancing. The Testing and Balancing Contractor shall, at no additional cost to the Owner, perform such re-testing and re-balancing as directed by and in the presence of the Owner’s Representative.
E. Where, in the opinion of the Testing and Balancing Contractor, there is excessive vibration, movement or noise from any piece of equipment, ductwork, or piping, these conditions should be noted in the final report with recommendations for corrective action.

END OF SECTION

SECTION 23 07 00: HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections, other Division 23 specification sections, and Division 26 specifications apply to work of this section.

1.2 RATING

A. All insulation systems, including jackets and adhesives shall be U.L. rated and FM approved. All insulation for indoor use shall have a maximum permanent flame spread rating of 25 or less and a smoke developed rating of 50 or less, as tested by ASTM E 84 (NFPA 255) method. Insulation in mechanical rooms shall have a maximum permanent flame spread rating of 25 or less and a smoke developed rating of 55 or less, as tested by ASTM E 84. Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150. Submit smoke and flame ratings for every material proposed for use.

1.3 SCOPE

A. Furnish and install insulation for the following:
1. Refrigerant suction piping.
2. Condensate drain piping.

1.4 QUALITY ASSURANCE

A. Insulation shall be installed by a contractor who specialized in the mechanical insulation trade and worked on projects of similar size and complexity over the past five years.
B. Insulation contractor shall be member of either the National Insulation Association (NIA) or the Southeastern Insulation Contractors Association (SEICA).

1.5 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
B. Submit, if requested by Designer, manufacturer's sample of each piping insulation type required, and of each duct and equipment insulation type required. Affix label to sample completely describing product.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

A. Flexible Elastomeric Pipe Insulation:
1. Manufacturer: Subject to compliance with the requirements, provide products from one of the following manufacturers:
a. Armacell AP Armaflex
b. Aeroflex USA
c. K-flex USA
d. Nomaco FlexTherm
2. Material: Closed cell pre-formed flexible elastomeric foam insulation. Comply with ASTM C 534 with maximum thermal conductivity (k value) of 0.28 at 75 degrees F.

3. Fittings, valves, and piping components Sleeve type fitting covers, and miter cut tubular form.
4. Insulation Adhesive – As recommended by manufacturer.

2.2 FIELD APPLIED JACKETS

A. Where required, the following jackets shall be applied in addition to the insulation jacket specified above.
   1. PVC fitting covers and jacketing, .030" (.3 mm) thickness of white, gloss finish, weatherable grade, UV resistant, PVC material. Flame spread/smoke developed of 25/50 per ASTM-E84. Install per manufacturer's specification.
      a. Fitting covers shall be shaped to exact fit. Longitudinal seam shall lap over from above to drain rainwater overlap.
      b. Attach with weld adhesive product provided by the jacket manufacturer. Provide bands as required and where requested.
      c. Manufacturers: John Manville Zestar 300, Owens Corning Speeline or Knauf PVC Jacketing Fitting Covers.
   2. Aluminum Jacket: 0.016-inch-thick sheet, embossed finish, with longitudinal slip joints and 2-inch laps, die shaped fitting covers with factory attached protective liner.

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. All insulation shall be applied by experienced journeymen in accordance with best trade practice. Work shall be as recommended by manufacturer's latest printed installation directions. Test, inspect, and clean all surfaces to be insulated before applying insulation. Take all possible precautions to protect work of other trades. Provide protective covering as required to accomplish this and be responsible for returning all equipment and material to its original new condition and appearance where damage occurs due to neglect.

3.2 PIPE INSULATION SHALL BE APPLIED AS FOLLOWS:

Area	Pipe System	Insulation	Thickness	Jacket
Interior Exposed	Condensate drain piping	Flexible Elastomeric	1"	PVC
Interior Concealed	Condensate drain piping	Flexible Elastomeric	1"	None
Interior Exposed	Refrigerant suction piping < 1"Ø	Flexible Elastomeric	3/4"	PVC
Interior Exposed	Refrigerant suction piping ≥1" Ø	Flexible Elastomeric	1"	PVC
Interior Concealed	Refrigerant suction piping < 1"Ø	Flexible Elastomeric	3/4"	None
Interior Concealed	Refrigerant suction piping ≥1" Ø	Flexible Elastomeric	1"	None
Exterior	Refrigerant suction piping < 1"Ø	Flexible Elastomeric	3/4"	Aluminum
Exterior	Refrigerant suction piping ≥1" Ø	Flexible Elastomeric	1"	Aluminum

3.3 SPECIFIC REQUIREMENTS

A. Flexible Elastomeric Pipe Insulation:
   1. Installation - Butt edges tightly, secure with elastomeric foam adhesive as recommended by insulation manufacturer.

3.4 DO NOT INSULATE

A. Vibration eliminators.
B. Equipment nameplates.

END OF SECTION

SECTION 232160

PIPES AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections, and other Division 23 specification sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of pipes and pipe fittings required is indicated on drawings and/or specified in other Division 23 sections.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:
1. Welding: Qualify welding procedures, welders and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and project site welding of piping work. Owner reserves the right to perform nondestructive testing of welded pipe joints by radiographic inspection whether or not explicitly required by code.
2. Owner reserves the right to utilize any testing procedure listed in Chapter VI ASME B31.1 to verify structural integrity of any weld(s) not meeting Engineer's approval. If integrity of weld(s) is found to be in compliance with ASME B31.1, Owner will pay for the additional testing cost. If weld(s) is found to be deficient, contractor shall be responsible for all costs associated with the testing and repair of the weld(s).

PART 2 - PRODUCTS

2.1 GENERAL

A. Where called for in the scope or where shown in drawings, use applicable products from those specified below.
B. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
C. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 COPPER TUBE AND FITTINGS

A. Applications: Condensate Drains:
B. ASTM B88 or ASTM B 306 Copper Tubing – Type (wall thickness) L, hard or soft temper as specified. Wrought copper or cast copper solder joint type fittings.
C. Specifications:
1. Copper Tube: ASTM B 88.
2. DWV Copper Tube: ASTM B 306.

3. ACR Copper Tube: ASTM B 280.
4. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
5. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
6. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
7. Wrought-Copper Solder-Joint Drainage Fittings: ANSI 16.29.
8. Cast-Copper Flared Tube Fittings: ANSI B16.26.
9. Bronze Pipe Flanges/Fittings: ANSI 16.24.
10. Wrought Copper and Copper Alloy Brazed Joint Fittings: ASTM B 50
11. Copper Tube Unions: Solder type, cast bronze, ground joint, 150 PSI SWP. Provide standard products recommended by manufacturer for use in service indicated.

2.3 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Pipe Joint Compound: Blue, Black or equal.
B. Pipe Thread Compound Garlock. Teflon tape may be used. Oil or lead not permitted.
C. Soldering Materials: Except as otherwise indicated, provide soldering materials as follows:
   1. Tin-Antimony Solder: ASTM B 32, Grade 95TA. (For pipe size 1-1/4" & under)
   2. Brazing Alloy: Silver 15%, copper 80%, phosphorous 5%. For pipe size 1-1/2" and larger.
   3. Gaskets for Flanged Joints: ANSI B16.21; raised-face for steel flanges, unless otherwise indicated.

2.4 DISSIMILAR PIPE UNIONS

A. Piping Connectors for Dissimilar Non-Pressure Pipe: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Dielectric unions are not permitted.
B. Piping Connectors for Dissimilar Pressure Pipe:
   1. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electric conductance), prevent galvanic action, and stop corrosion. Dielectric unions are not permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. All 90-degree elbows shall have long radius. Two 45-degree elbows in lieu of one 90-degree elbow are not permitted where short elbows are used. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.
B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs unless such routing is clearly indicated on the drawings. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not other-wise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building.
C. Provide unions at final connections to all equipment. Use reducing fittings when changing pipe sizes.
D. Grade condensate drain lines 1/8 inch per foot.
E. Insulating Unions Required wherever piping of different material is joined.

3.2 PIPING SYSTEM JOINTS

A. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape

(Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

B. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
C. Copper to Screwed Cast bronze to iron adaptor with insulating gasket.
D. Black Steel Screwed (above ground) - malleable iron fittings.
E. All piping connections shall be with pre-manufactured fittings (T, elbow, etc.) or with "weldolets," "threadolets" or "sockolets." This includes instrumentation such as thermometer wells, etc.

    1. "Weldolets" with outlet size 2-1/2" and larger and "Threadolets" or "Sockolets" with outlet size 2" and smaller may be used for branch takeoff up to one half (1/2) diameter of main. Use "Threadolets" where threaded fittings are specified and use "Sockolets" where socket weld fittings are specified. Materials of "Weldolets" and "Threadolets" shall match material of piping.
    2. Mitered ells, welded branch connections, notched tees and "orange peel" reducers are not allowed. Unless specifically indicated, reducing flanges and reducing bushings are not allowed.

F. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

3.3 CLEANING, FLUSHING, INSPECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water.

END OF SECTION

SECTION 232300

REFRIGERANT PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections and other Division 23 specification sections, Division 22, and Division 26 specifications apply to work of this section.

1.2 QUALITY ASSURANCE

A. Codes and Standards:
1. ANSI Compliance: Fabricate and install refrigerant piping and specialties in accordance with ANSI B31.5 and extend applicable lower limits to pressures below 15 psig.
2. ASHRAE Compliance: Fabricate and install refrigerant piping and specialties in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping and specialties materials and products.

PART 2 - PRODUCT

2.1 PIPE AND FITTINGS

A. General: provide pipes and pipe fittings complying with ASTM B280 for refrigeration service, in accordance with the following listing:
1. Size 1" and Larger: Copper tube: Type K, soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints.
2. Size 3/4" and Smaller: Copper tube; Type ACR soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints.
3. Soldered Joints: Solder joints using silver-lead solder, ASTM B32, Grade 96 TS.

2.2 SPECIAL REFRIGERANT VALVES

A. General: Special valves required for refrigerant piping include the following types:
1. Globe and Check Valves:
a. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 deg.F temperature rating, 500 psi working pressure.
b. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250 deg.F temperature rating, 500 psi working pressure.
2. Solenoid Valves: 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, 1/2" conduit adapter, 250 deg.F temperature rating, 400 psi working pressure.
3. Manual Operator: Provide manual operator to open valve.

2.3 MISCELLANEOUS SPECIALTIES

A. Refrigerant Strainers: Brass shell and end connections, brazed joints, model screen, 100 mesh, UL-listed, 350 psi working pressure.
B. Moisture-Liquid Indicator: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200 deg.F temperature rating, 500 psi working pressure.
C. Refrigerant Filter - Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
D. Evaporator Pressure Regulators: provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporated pressure regulator, in size and working pressure indicated, with copper connections.
E. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment for use in service indicated, UL-listed.

2.4 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
C. Pipe Escutcheons for Dry Areas: Provide stamped steel escutcheons, solid or split hinged, 22 gauge minimum.

2.5 DIELECTRIC CONNECTIONS

A. Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

PART 3 - EXECUTION

3.1 INSTALLATION OF REFRIGERANT PIPING

A. Install refrigerant piping with 1/4" per foot (1%) downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.
B. Clean refrigerant piping by swabbing with dry lineless (linen) cloth, followed by refrigerant oil-soaked swab. Remove excess oil by swabbing with cloth solvent in high flash point petroleum solvent, squeezed dry.
C. Bleed dry nitrogen through refrigerant piping during brazing operations.
D. Provide sleeves for refrigerant piping routed under and through building floors and walls.

3.2 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surfaces.
B. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.3 FIELD QUALITY CONTROL

A. Refrigerant piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5., "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all

joints. Perform final test with 27" vacuum, and then 200 psi using electronic leak detector. System must be entirely leak-free.

B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

3.4 DEHYDRATION AND CHARGING SYSTEM

A. Refrigerant charging shall be conducted under the supervision of an EPA certified technician. This technician shall have certification for the size and type of equipment being installed, per Section 608 of the EPA Clean Air Act.
B. Install core in filter dryer after leak test but before evacuation
C. Evacuate refrigerant system with vacuum pump, per manufacturer's recommendation.
D. During evacuation, apply heat to pockets, elbows, and low spots in piping.
E. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
F. Break vacuum with refrigerant gas, allow pressure to build up 2 psi.
G. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

END OF SECTION

SECTION 233100

DUCTWORK AND DAMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections and other Division 23 specification sections, and Division 26 specifications apply to work of this section.

1.2 QUALITY ASSURANCE

A. Codes and Standards:
1. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B “Standard for the Installation of Warm Air Heating and Air Conditioning Systems”.
2. SMACNA HVAC Duct Construction Standards – Metal and Flexible - 2005
3. SMACNA Duct Leakage Test Procedures – 1985

B. Noise and vibration control are of high importance and should be given priority during the fabrication and installation of the ductwork.

1.3 SHOP DRAWINGS

A. Prior to procurement or manufacturing, submit for approval appropriate shop drawings and/or descriptive literature giving performance data, physical size, wiring diagrams, configuration, capacity, material, etc., for all items under this Division including the following:
1. Duct construction materials and joining systems
2. Duct sealants
3. Turning vanes
4. Flexible duct connections
5. Backdraft dampers
6. Volume control dampers
7. Automatic control dampers
8. Duct test holes

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS:

A. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lock forming quality; with G 90 zinc coating in accordance with ASTM A 525.

B. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A 167; Type 302, 304, or 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

C. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14.

2.2 FABRICATION:

A. General:

1. All low velocity sheet metal ductwork shall be constructed in accordance with recommendations of Low Pressure Duct Construction Standard, of Sheet Metal and Air Conditioning Contractors National Association, Inc., Third Edition, 2005, AIA File No. 30-D-4, hereafter abbreviated SMACNA-I and latest recommendations of the ASHRAE Handbook "HVAC Systems and Equipment." Duct systems shall be complete including all duct fittings, turning vanes, hangers, and supports shown on drawings and in SMACNA-I. Reference to plate numbers and figure numbers apply to this Duct Manual.

B. Shop fabricated ductwork in maximum 8-ft lengths, unless otherwise indicated. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

C. Shop fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards" (Third Edition, 2005).

D. Cross-break all flat panels between bracing except where rigid insulation is applied.

E. Elbows shall be standard radius or square with air foil double vanes, round duct elbows shall be of five-piece construction.

F. Transitions shall be made with maximum angle of 15 degrees with straight duct for diverging flow, 20 degrees for converging flow.

G. In the rectangular duct construction, tie rods for return air, supply air, outside air, and exhaust air will not be allowed.

2.3 TURNING VANES:

A. Vanes shall be manufactured from minimum 26-gauge electro-galvanized steel and sides shall be manufactured from minimum 24-gauge electro-galvanized steel with assembly slots located on design centers of 2.4 inches. Turning vanes shall be high-efficiency profile type (H.E.P.) as manufactured by AERO DYNE Sound Control Co., or approved equal by Duro Dyne, or Ductmate Industries, Inc. Submit shop drawing for approval.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Connector: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   2. Net Fabric Width: Approximately 6 inches wide.
   3. Metal: 3-inch-wide, 24 gage galvanized steel.

2.5 DAMPERS

A. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

B. Volume Control Dampers: Provide where specified above, where indicated on drawing and in all branches or at all supply, return air, exhaust or transfer openings required to balance system whether or not specifically shown on drawings Dampers shall be locking quadrant type, manual balancing clamps.
   1. Blades: 22 gauge minimum galvanized sheet steel for rectangular 20 gauge for round.
   2. Frames: 22 gauge minimum galvanized sheet steel for rectangular, 20 gauge for round
   3. Bearings: Synthetic.
   4. Control shaft/hand quadrant: 3/8" square axle shaft, extending beyond frame with factory supplied locking hand quadrant for field mounting. Provide 2" hand quadrant standoff bracket for dampers installed on duct wrapped with external insulation.
   5. Accessibility: All dampers shall be adjustable after building is completed. Where dampers are hidden behind furred spaces, damper rods shall be adjustable from flush mounted boxes similar to the Young concealed damper regulator.

6. Make: Ruskin MD25 for rectangular and MDRS25 for round, or equivalent by Arrow United Industries, NCA, Pottorff, or Vent Products Co., Inc. Shop built dampers will also be acceptable if constructed per SMACNA with quality of materials and features indicated above.

C. Automatic control dampers: Provide and install control dampers where specified or indicated on drawings. Damper motors will be furnished and installed by the DDC Contractor. Control and low voltage power wiring will be provided by DDC contractor. Provide transition or blank off baffles where required to suit damper size.
1. Type: Opposed blade for modulating service or non-modulating service. Parallel blade is acceptable for non-modulating service.
2. Blades: 16 gage minimum galvanized sheet steel, interlocking design.
3. Frames: 16 gage minimum galvanized sheet steel.
4. Bearings: Nylon
5. Seals: Synthetic elastomer installed on blade edges and top and bottom strips of each damper, with flexible metal compression seal on sides.
6. Leakage: Conform to leakage requirements as prescribed by SMACNA for medium pressure duct systems.
7. Automatic Control Damper actuators shall provide pilot positioning where sequenced operation is required with adjustable starting point and range, 25% surplus power, spring return.
8. Make: Ruskin CD-60 low leakage, low noise damper or approved equal by Arrow United Industries, NCA, Pottorff, or Vent Products Co.

2.6 DUCT TEST PORTS

A. Permanent Test Ports: Factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL DUCTWORK:

A. General:
1. Assemble and install ductwork to achieve airtight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Rigid metal ducts shall be installed with support systems in accordance with SMACNA HVAC duct construction standards. Horizontal ducts shall have a support within two feet of each elbow and within four feet of each branch intersection. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.
2. Tape all return and supply duct joints with UL listed tape. Make shall be HARDCAST Foil-Grip 1403-181BFX, Shurtape Mastic SF-685, or Avery Dennison, except where Ductmate System is used.

B. Duct Joints
1. Transverse duct joints in rectangular ducts subject to less than 2” pressure shall be made as recommended in SMACNA-I.
2. Transverse duct joints in rectangular ducts subject to 2” or higher pressure shall be made with the Ductmate System or an approved equal. The Ductmate System components shall be of standard catalog manufacture as supplied by Ductmate Industries, Inc., of Pittsburgh, PA or Stockton, CA., Automated Ductwork Mfg. Co., McGill Airflow Corp.
3. The installation of the Ductmate System shall be in accordance with the manufacturer's printed instruction and installation manual. Ductmate joints are equivalent of SMACNA Angle Reinforced Standing Seam (T-16).
4. The Ductmate angle shall be securely fastened to the duct walls using spotwelding, self-drilling screws or rivets. Fasteners spacing shall be as recommended in the manufacturer’s installation manual for the applicable pressure class.

5. A continuous strip of closed cell gasket tape, size 1/4-inch x 3/4 inch shall be installed between the mating flanges of the companion angles at each transverse joint and joint shall be made up using 3/8-inch diameter x 1 inch long plated bolts and nuts. Drive-on or snap-on cleats shall be used at spacing as recommended in the manufacturer's installation manual.

C. Round Duct
   1. Ductwork shall be installed according to manufacturer’s recommendations.

D. Flexible Duct Connections: Install at all fans, ventilating units and ducts crossing building expansion joints and where condensation may occur.

E. Trim Collars: Wherever duct passes exposed to view through walls, the opening shall be framed with 1-inch x 1-inch x 1/8-inch angles on both sides of partitions with corners mitered, welded and ground smooth.

F. Turning Vanes: Shall be installed in all square elbows.

3.2 ADJUSTING AND CLEANING:

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed. Similarly, provide temporary closure of ends of all prefabricated ductwork in storage.

END OF SECTION

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division 01 Specification sections, other Division 23 specification sections, and Division 26 specifications apply to work of this section.

1.2 QUALITY ASSURANCE:

A. AMCA Compliance: Provide power ventilators which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal.
B. U.L. or CSA Approval: All power ventilators shall be U.L. Listed or C.S.A. approved.

1.3 SUBMITTALS:

A. Manufacturer's Data: Submit manufacturer's technical data for power and gravity ventilators, including specifications, capacity ratings, fan curves, sound data, dimensions, weights, materials, accessories furnished, and installation instructions.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Furnish and install all fans in accordance with capacities indicated on the schedule in the drawings complete with motors and drive assemblies, belt guards, motor control equipment, disconnect switches, dampers and all accessories noted.
B. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.
C. Manufacturer: Greenheck, Loren Cook, Penn Barry, Carnes, Twin City Fan or approved equal.

2.2 POWER VENTILATORS:

A. Centrifugal Exhaust or Relief Fans Rooftop Up Blast or Sidewall Discharge: Provide centrifugal type power ventilators of type, size, and capacity as scheduled, and as specified herein.

1. Type: Centrifugal fan, direct driven as scheduled. Provide housing constructed of heavy gauge aluminum including exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable. Housing shall have a rigid internal support structure. Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing. Windband to include an integral rolled bead for strength. Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable. Curb cap to have an integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to curb.
2. Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it.
3. Drive Frame: Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
4. Motor Cover: Motor cover shall be constructed of aluminum.
5. Bird Screens: Provide bird screens, 1/2" mesh, stainless steel, aluminum or brass wire.
6. Motors shall be a DC electronic commutation type motor (ECM) specifically designed for fan applications. Motor enclosure shall be open drip proof type. Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.
7. Electrical: Provide factory wired non fusible type NEMA 3R disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor.
8. Wheel: Provide composite or aluminum, non-overloading, backward inclined centrifugal wheel, statically and dynamically balanced in accordance to AMCA Standard 204-05. The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency.
9. Vibration Isolation: Provide double studded or pedestal style isolators, no metal to metal contact, sized to match the weight of the fan.
10. Dampers: Provide gravity actuated damper accessory where called for in the equipment schedule, galvanized frames with prepunched mounting holes.
11. Provide rooftop fans with roof curbs as described below. Provide sidewall discharge fans with manufacturer's standard wall mounting kit.
12. Provide Greenheck Vari-Green HOA Controller (or approved equal by other fan manufacturers).
    a. The controller shall provide the sequence of operation indicated on the drawings.
    b. The controller shall receive input from a simple thermostat to its dry input terminal.
    c. The controller shall start and stop EF-2 based on the temperature of the elevator shaft.
    d. The two damper operators will need to share an electrical circuit which the controller will turn on and off. Coordinate with the electrical contractor.
13. Manufacturer: Greenheck CUE-90-VG, Loren Cook, Penn Barry, Carnes, Twin City Fan or approved equal.

B. Inline Exhaust Fans with Rectangular or Square Housings: Provide centrifugal inline type power ventilators of type, size, and capacity as scheduled, and as specified herein.

1. Duct mounted exhaust fans shall be of the centrifugal direct drive in-line type. The fan housing shall be of the rectangular or square design constructed of heavy gauge galvanized steel and shall include duct mounting collars.
2. The fan wheel shall be forward curved centrifugal type, constructed of galvanized steel or calcium carbonate filled polypropylene. Wheels shall be statically and dynamically balanced in accordance with AMCA Standard 204-05.
3. Motors shall be a DC electronic commutation type motor (ECM) specifically designed for fan applications. Motor enclosure shall be open type. Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall

be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

4. Dampers: Provide spring loaded aluminum backdraft damper where called for in the equipment schedule.
5. Duct Collars: Rectangular or square design to provide a large discharge area.
6. Fans shall be Greenheck CSP-A390-VG, Loren Cook, Penn Barry, Carnes, Twin City Fan or approved equal.

C. Wall Cap: Provide hooded wall cap with rectangular duct connection designed for outside wall applications.

1. Construct wall cap of steel with black enamel finish, built-in birdscreen, and damper.
2. Wall cap shall be Greenheck Model WC-10x3 or approved equal by other acceptable fan manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF POWER VENTILATORS:

A. Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.
B. Install per manufacturer's instructions and drawing details.

3.2 FIELD QUALITY CONTROL:

A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of units at performance requirements specified.

END OF SECTION

SECTION 233715

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections, and other Division 23 specification sections apply to the work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
B. Types of air outlets and inlets required for project include the following:
1. Exhaust Grilles - Perforated
C. Codes and Standards:
D. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
E. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
F. The grilles shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
G. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
B. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
C. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
D. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, noise criteria ratings, and minimum one-year warranty. Indicate selections on data.
E. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
F. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air outlets and inlets wrapped in factory-fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

PART 2 - PRODUCTS

2.1 EXHAUST GRILLES - PERFORATED

A. General: Perforated exhaust and return grilles shall be of the sizes and mounting types as shown on the plans and outlet schedule. Grilles shall be aluminum faced with 51% free area perforated face and a steel border and backpan. Perforated holes shall be 3/16" diameter on 1/4" staggered centers. Units shall be designed for use in ducted return or exhaust applications.
B. Outer border of units shall be steel construction. The perforated aluminum face shall be removable allowing access to the interior of the grille. Face shall be secured in place with tension spring clips. Units shall be designed to integrate into the specified ceiling system.
C. Finish: The diffuser finish shall be standard white except where noted otherwise on the drawings. Paint process shall be anodic electro-deposition using an anodic acrylic paint. Units shall undergo pre-treatment including a pressurized spray stage using an alkaline cleaner and a de-ionized water rinse.
D. The manufacturer shall provide published performance data for the diffuser.
E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering Grilles and Registers which may be incorporated in the work include; but are not limited to, the following:
    1. Price Industries, Inc. Model PDDR or approved equivalent by
    2. Metalaire
    3. Titus Products Inc.
    4. Carnes Company
    5. Nailor Industries, Inc.
    6. Krueger
    7. Tuttle & Bailey

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.
B. Provide all control components and accessories as necessary for complete, operational functioning of louver-dampers and associated fans.
C. Contractor shall externally insulate the slot diffuser plenums to match ductwork insulation.

END OF SECTION

SECTION 238148

DUCTLESS SPLIT SYSTEM AIR COOLED HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND RELATED WORK SPECIFIED ELSEWHERE:

A. Related Documents
1. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections and other Division 23 specification sections, Division 22, Division 26, and Division 28 specifications apply to work of this section.

1.2 SUBMITTALS:

A. Manufacturer's Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories; and installation and start-up instructions.
B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of condensing units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:
1. Capacity ratings for heat pump/condensing units shall be in accordance with ARI Standard 360, "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment" for units of 135 MBH capacity or greater; ARI Standard 210 "Standard for Unitary Air-Conditioning Equipment" for units of capacity less than 135 MBH.
2. Refrigeration system of heat pump/condensing units shall be constructed in accordance with ASHRAE standard ASHRAE 15 "Safety Code for Mechanical Refrigeration".

PART 2 - PRODUCTS

2.1 AIR-COOLED HEAT PUMP/CONDENSING UNITS:

A. General: Factory assembled and tested high efficiency, inverter driven, ductless split system air-cooled heat pump/condensing units, consisting of casing, compressors, condenser coils, condenser fans motors, and unit controls. Capacities and electrical characteristics as scheduled. Acceptable refrigerants shall be R-410A, R-454B, or R-32.
B. Manufacturers: Provide systems that meet the specification requirements by LG (Basis of Design), Sea Breeze Air Systems, or Mitsubishi.
C. Indoor Ductless Split Unit: Designed for indoor installation and complete with protection for components and controls. Provide the following with the unit.
1. Freezestat to prevent coil freezeup.
2. Built in power failure automatic restart.
3. Wall mounted, 24-volt, electronic programmable thermostat capable of 5/1/1 programming and night/weekend set-back function.
4. Automatic Heating and Cooling Changeover.
5. Single zone.
6. Low ambient heating capability, 75% of heating capacity at 5°F.
D. Outdoor Heat Pump Section: Hermetic scroll-type compressor, designed for air-cooled condensing, complete with crankcase sight glass, crankcase heater, thermal expansion valve, and backseating service

access valves on suction and discharge ports. Capacity shall be controlled by cycling or modulating compressor speed. Additional features shall include:

1. Crankcase heater in well within crankcase;
2. Capacity steps as scheduled or recommended by manufacturer.
3. Painted steel wall mounting brackets.

E. Controls: Operating and safety controls shall include high and low pressure cutouts, oil pressure cutout, compressor winding thermostat cutout, 3-leg compressor overload protection, and condenser fan motors with thermal and overload cutouts. Provide magnetic contactors for compressor and condenser fan motors. Provide modulating condenser fan for head pressure control at low ambient conditions. Provide automatic nonrecycling pumpdown, timing device to prevent excessive compressor cycling, and time delay relays for dual compressor units.

F. Condensing Section: Condenser coil shall be seamless copper tubing mechanically bonded to heavy duty, configured aluminum fins, systems shall utilize a separate compressor for each indoor air handling unit. Units shall include liquid accumulator and subcooling circuit, and backseating liquid line service access valve. Condenser coils shall be factory tested.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install air-cooled heat pump/condensing units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

3.2 FIELD QUALITY CONTROL:

A. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

3.3 DEMONSTRATION:

A. Start-up air-cooled heat pump/condensing units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

B. Train Owner's personnel on start-up and shutdown procedures, troubleshooting procedures, servicing, and preventive maintenance schedule and procedures. Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals specified in Division One.

END OF SECTION

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SECTION 260116 — ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this section shall comply with all applicable requirements of Section 260500, General Provisions.

1.2 DESCRIPTION OF WORK

A. The extent of demolition work shall be in general, but not limited to:

1. Removal and/or relocation of existing power, cable and conduit in existing walls or floors being demolished for new entries, toilets and elevator machine room.

2. Circuits that are required to be relocated shall be investigated and renovated to accommodate new construction. Test all such circuits to ensure operability and safe connections.

B. Demolition includes removal and disposal of demolished materials not specifically noted to remain or to be stored.

1.3 JOB CONDITIONS

A. Occupancy: Building will be occupied during work.

B. Condition of existing systems: The Owner assumes no responsibility for actual condition of items to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable.

C. Protection: Ensure safe passage of persons in and around areas of demolition. Conduct operations to prevent injury to building, structure, other facilities and persons.

D. Damages: Promptly repair damages caused to facilities by demolition operations at no cost to Owner.

E. Utility Services: Maintain existing service entrance utilities and gear during demolition operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMOLITION

A. Demolition: Demolition of all parts to be removed shall be done in a safe, orderly fashion, taking care to avoid damage to parts which are to be left in place. All debris shall be removed from the premises as it is generated and shall not be allowed to accumulate. In the event the Contractor has any questions regarding items to be removed, the Contractor is to ask the Engineer.

B. Disposal of Demolished Materials:
   1. Contractor shall investigate all existing circuits on equipment and/or walls to be removed and shall remove any electrical equipment associated with items to be removed. In general, equipment conduit and cable shall be completely removed. Conduit in walls being demolished shall be removed. Circuit conductors which are part of multi-device branch circuits such as lighting or receptacles shall be completely removed.
   2. General: Remove from site, debris, rubbish and other materials resulting from demolition operations.
   3. Removal: Transport demolished materials removed from premise and legally dispose of off site.
   4. All lighting fixtures containing PCB’s shall be removed disposed of as required by the latest environmental regulations and per local requirements.

END OF SECTION 260116

SECTION 260500— GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The provisions of all other sections of Division 1 of these Specifications shall govern the work under this Division or Section the same as if incorporated herein.

1.2 SCOPE

A. The Contractor shall provide and install complete electrical systems including all conductors, raceways, fittings, protective devices, wiring devices, fixtures, supports, and all miscellaneous hardware necessary. All of the above equipment shall be completely installed and left in proper operating condition. All electrically powered equipment whether furnished by others or by the Contractor shall be wired by the Contractor.

B. Complete Power distribution and utilization system shall be installed, including panels, utilization devices and equipment as indicated on drawings. The existing utility service shall remain.

C. The Contractor shall furnish and install power, wiring and/or disconnects as shown on drawings for wiring systems for mechanical systems specified in the Mechanical Divisions of the specifications. Temperature control wiring, equipment control and interlock wiring are not included in this division unless specifically noted in these specifications or shown on the plans. All motor disconnects, starters, combination motor controllers and motor control centers shall be furnished under this division of specifications unless noted otherwise.

1.3 REQUIREMENTS

A. Field verification of scale on electrical plans is directed since actual locations, distances and levels will be governed by actual field conditions.

B. In case of conflicts or discrepancies between plans, plans and specifications and/or actual field conditions, Contractor shall notify the Engineer before work is continued. Coordinate with other trades to avoid conflicts.

C. Permits, and Tests - The Contractor shall procure and pay for all permits, fees and licenses required. Perform all tests to ensure all systems are in good operating condition.

D. Review of Material; Specific reference in the specification to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, with or without the words "or equal", shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

E. Bidders shall base bids on the material specified or on equals receiving approval 10 days prior to Bid Opening. Any increase in the cost of work resulting from substitution of any product specified is part of this contract and shall be accomplished in an approved manner at no extra cost to the Owner.

F. Substitutions. No substitution will be considered unless written request for approval has been received by the Engineer at least 10 days prior to the date of receipt of bids. Each such request 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, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute would require shall be included; failure to do so does not alleviate the Contractor of his responsibility to make any and all necessary changes required for installation of the approved substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The Engineer's decision of approval or disapproval of a proposed substitution shall be final.

G. All materials shall be new and of current manufacturer. Where more than one of a type of device is used, all shall be by the same manufacturer. All materials shall conform to the grade, quality and standards of those specified.

H. Shop drawings shall be submitted in accordance with the General Conditions. Forward all shop drawings at one time. Each item shall bear project name and identifying symbol from plans. Shop Drawings required are as follows:
1. Lighting Fixtures
2. Wiring Devices
3. Panelboards
4. Disconnect Switches
5. Contactors
6. Time Clocks
7. Fire Alarm System Equipment

I. Interferences - The drawings are generally diagrammatic in nature, and accordingly the Contractor shall coordinate his work with that of all other trades to avoid interferences. The Contractor shall examine the complete set of drawings and specifications for the job before installation of electrical work, coordinating locations and routings with other trades to avoid interferences. Work installed by the Contractor which does interfere with another trade shall be removed and reinstalled at the Contractor's expense when directed by the Architect.

J. Workmanship shall be of the highest quality and all work shall be done by workmen skilled in the trades involved.

K. The Contractor shall guarantee all work under this contract for one year and shall be responsible for the maintenance of all electrical equipment furnished and installed under this contract, excluding lamp replacement, for a period of one year from the date of substantial completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 APPLICABLE CODES AND STANDARDS

Note: The materials and installation shall conform to the minimum requirements and latest outstanding issues and revisions of the following codes, standards, and regulations wherein they apply:

NFPA No. 70, National Electrical Code, (2020 edition)

IBC (2018), IECC (2018), IFC (2018)

American National Standard

National Electrical Safety Code (2021)

Applicable Publications of NEMA, ANSI, IEEE and IPCEA.

Underwriter's Laboratories, Inc. Standards

City, State and Local Codes and Regulations having jurisdiction.

OSHA requirements.

ADA requirements.

END OF SECTION 260500

SECTION 260501 — BASIC MATERIALS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this section shall comply with all applicable requirements of SECTION 260500, GENERAL PROVISIONS.

1.2 SCOPE

A. Contractor Furnished. Unless otherwise noted on the drawings, equipment list, or specifications, the Contractor shall furnish and install all materials, devices, and apparatus necessary for the complete electrical system. All materials and equipment shall be of types and manufacturer specified wherever practical. Should materials or equipment so specified be unobtainable, the Contractor shall submit the description and manufacturer's literature, reason for the substitution request and shall secure the approval of the Engineers before substitution of other material or equipment. This specification establishes performance requirements and the quality of equipment acceptable for use and shall in no way be construed to limit procurement from other manufacturers.

B. Equal or Equivalent. The term "or equal" and similar terms as used on the drawings or specifications shall be interpreted to mean "equal or equivalent" in the opinion of the Engineers.

C. Manufacturer's Prints. Where the Contractor furnishes equipment other than standard construction items, he shall furnish manufacturer's prints and reproducibles of all such equipment to the Engineers.

D. U.L. Listing. All equipment and materials shall be new and conform to the requirements of this specification. All equipment and materials shall be listed by the Underwriter's Laboratories, Inc., and shall bear their label whenever standards have been established and label service is regularly furnished. All equipment and materials shall be of the best grade of their respective kind for the purpose.

PART 2 - PRODUCTS AND EXECUTION

2.1 PANELBOARDS

A. Contractor Furnished. The contractor shall furnish all lighting, service, and power distribution panelboards required. All panelboards shall be of deadfront construction and shall incorporate all switching and protective devices of the type, quantity, number of poles, rating and type specified or shown on the drawings. The drawings and schedules indicate the ampere rating of mains, main breaker or disconnect, main lugs, voltage rating, phases, neutral and type of devices and enclosures. Enclosures for panelboards may be flush or surface type as designated on the drawings.

B. Boxes. Boxes shall be constructed of code gauge galvanized sheet steel and provided with not less than 7" wiring gutters at the sides and 5" at top and bottom. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment (loop feeds), the box shall be sized to include this wiring space. This wiring space shall be in addition to the minimum gutter space specified above and the limiting width may be increased accordingly. Knockout type boxes may be used on flush mounted installations where conduits are routed concealed. Surface mounted boxes shall be furnished without factory stamped knockouts and the contractor shall punch the box for the conduit group desired. Conduit hubs shall be T&B Series 370 "Bullet" hubs or approved equal.

C. Doors. Hinged doors covering all switching device handles shall be included in all panel trims, except that panelboards having individual metal clad externally operable deadfront units may be supplied without such doors. Doors shall have flush or semi-flush type, corrosive resistant, cylinder lock and catch, except that doors over 48" in height shall have a vault handle and 3-point latch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike for all panelboards supplied. Trims shall be fabricated of code gauge sheet steel. Trims for flush panels shall overlap the box by at least 3/4" all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screw-driver without the need for special tools. Trims shall be properly cleaned and finished with a gray paint over a rust inhibiting primer coating. The finish coat shall be the type that will permit adherence of field applied paint.

D. Directory. A directory holder with glass or heavy plastic plate and metal frame shall be mounted inside of each door with a neatly typed directory properly identifying each circuit as shown on panel schedule drawings.

E. Nameplate. The contractor shall furnish and install an engraved, laminated plastic nameplate on the trim. The nameplate shall identify the panel by power source designation, panel designation, voltage rating and phase. Nameplate shall be black engraved letters on white background.

F. Bus Bars. Bus bars and other conductive parts shall be copper and sized in accordance with Underwriter's Laboratories standards, full size insulated neutral bars shall be included. Bussing shall be braced equal to or greater than the highest rated practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

G. Neutral Bus. Neutral bussing on 3-phase panels shall have a suitable lug for each outgoing feeder requiring a neutral connection.

H. Ground Bus. All panels shall be furnished with a bare equipment ground bus. The ground bus shall be of copper and 1/4" x 2" minimum size, properly bonded to the housing. Suitable lugs shall be provided for termination of each equipment ground conductor.

I. Phase Sequence. Bus bar connections to the branch circuit shall be the "distributed phase" or "phase sequence" type. Single-phase, three-wire panelboard bussing shall be such that any two adjacent single-pole units are connected to the opposite polarities in such a manner that two-pole units can be installed at any location. Three-phase, four wire bussing shall be such that any three adjacent single-pole units are individually connected to each of the three different phases in such a manner that two or three-pole units can be installed in any location.

J. Circuit Numbering. Panelboard circuit numbering shall be such that starting at the top, odd numbers shall be used in sequence down the left-hand side and even numbers shall be used in sequence down the right-hand side.

K. Terminals. Terminals for feeder conductors to the panelboard mains and neutral shall be U.L. listed as suitable for type of conductor specified and shall be T&B 54000 Series where possible. Terminals for branch circuit wiring, both breaker and neutral, shall be U.L. listed as suitable for the type of conductor specified.

L. 120/208V Panels. All lighting/service panels rated 120/208 volt, shall be equal to Square D Company, Type NQOD equipped with bolt-on branch breakers of the type and rating specified on the drawings.

M. Panels and Panelboards are designed around Square D equipment. Acceptable alternate manufacturers are Eaton, Siemens, and General Electric Company. All alternate or substitution requests shall meet all performance requirements of specified equipment, as well as space and dimension requirements noted on drawings.

2.2 CIRCUIT BREAKERS

A. Contractor Furnished. The contractor will provide breakers unless specifically designated to be "Owner Furnished" on the drawings, equipment list, or within the specifications.

B. As Specified. Breakers shall be of the type, rating, number of poles, size, and interrupting capacity, specified or required for the environment, location, application, and load served.

C. Molded Case Circuit Breakers. Molded case circuit breakers shall be circuit interrupting devices which will operate both manually for normal switching functions and automatically under overload and short circuit conditions. Circuit breakers shall provide circuit protection when applied within rating.

D. Operating and Switching Mechanism. The operating mechanism shall be entirely trip-free so that the contacts cannot be held closed against an abnormal over-current or short circuit condition. The switching mechanism shall be quick-make, quick-break type.

E. Overload and Short Circuit Protection. The operating handle of the circuit breaker shall open and close all poles of a multi-pole breaker simultaneously. The breakers shall meet applicable NEMA and U.L. specifications. Each circuit breaker shall have a trip unit to provide overload and short circuit protection. The trip unit for each pole shall have elements providing inverse time delay under overload conditions and instantaneous magnetic tripping for short circuit protection. The trip element shall operate a common trip bar which shall operate all poles in case of an overload or short circuit through any one pole. Automatic tripping shall be clearly indicated by handle position.

F. Rating. The molded case circuit breakers shall be rated for fault duty as specified on the plans. Series ratings are not allowed. The Contractor shall verify available fault current with the Utility Company for the actual installation and forward to the Engineer.

2.3 SAFETY SWITCHES

A. Contractor Furnished. The contractor shall provide all safety disconnect switches required. The switches shall be of the type, voltage, ampere, and horsepower rating, number of poles, fusible or nonfusible, as specified or required for the environment, location, application, and load served.

B. Description. All safety switches shall be NEMA premium heavy duty, horsepower rated, industrial type, and shall be Underwriters' Laboratories listed. Fusible switches shall be complete with fuses of the type and rating specified (refer to paragraph "Fuses") and as indicated on the drawings or within these specifications. All switches shall have switch blades that are fully visible in the OFF position when the door is open and shall be of dead front construction with arc suppressors. The mechanism shall be quick-make, quick-break type. The door shall be interlocked (defeatable type) with the handle or mechanism to prevent unauthorized opening of the door in ON position. Pad-locking provisions shall be provided for padlocking in the OFF position with one or more locks or lockable hasps. Grounded switches in a common enclosure shall be mounted in enclosure types specified elsewhere. Individually mounted switches shall be mounted in enclosures suitable for the location and environment as specified on the drawings.

C. Nameplate. All switches shall be provided with an engraved laminated phenolic nameplate showing the power source (Unit No. or other), and title of equipment served. Nameplates to be black letters on white background.

D. Manufacturer and Enclosures. All switches furnished shall have enclosures as specified on the drawings. Acceptable manufacturers shall be Square D, General Electric, Siemens, and Eaton.

2.4 FUSES

A. Contractor Furnished. The contractor shall furnish and install fuses in all fusible devices and equipment that are furnished by the contractor.

B. Manufacturer and Listing. The following fuse types shall be used for the applications listed. The following are trade names of the Bussman Manufacturing Division, however, equivalent products by Chase Shawmut Division shall be acceptable.

Application	Trade Names	Class	Voltage (Type)
Motors, Transformers & Miscellaneous Equipment 0-600 Amps	Fusetron	K-5 K-5	240 (FRN) 600 (FRS)
Panelboard Feeders & Service Disconnects 0-600 Amps	Low Peak Low Peak	RK-5 RK-5	240 (LPN-R) 600 (LPS-R)

2.5 MISCELLANEOUS CONTROL DEVICES

A. Furnished by Others. Miscellaneous control devices such as duct switches, air flow switches, thermostats and temperature control devices, and similar equipment shall normally be furnished under another division. Any such device that is to be furnished under this division shall be specifically designated on the drawings.

B. Enclosures. All devices furnished shall be suitable for the control requirements and shall have voltage rating and adequate capacity for the application. They shall be housed in enclosures suitable for the location and environment as indicated on the drawings.

2.6 RECEPTACLES – OUTLETS

A. Contractor Furnished. The contractor shall furnish and install all convenience (and power type) receptacles and outlets shown on the drawings. Suitable boxes, covers and matching plugs as specified shall be provided and the installation shall conform to typical details, drawings, and as described elsewhere in this specification. See electrical symbol drawings for additional descriptive data.

B. Single Manufacturer. Receptacles of similar usage and rating shall be those of a single manufacturer.

C. Usage and Manufacturer. General use and convenience outlets shall be as specified by symbol on the drawings and as listed on the symbols drawing.

D. Ground Fault Protection. Note that all convenience receptacles to be installed as ground fault interrupting type are so noted on drawings.

2.7 BOXES

A. Contractor Furnished. The contractor shall furnish and install all electrical boxes required for the proper installation of the electrical systems. Boxes shall be of the NEMA type suitable for the location. Boxes shall be installed as specified on the drawings and as described under "Wiring Methods", and other applicable sections of this specification for wiring devices such as switches, receptacles, and similar devices. In order to maintain fire ratings, boxes installed "back-to-back" in fire walls shall not be located in the same space between studs, but shall have a stud located between them.

B. Concealed. Fixture, outlet, and switch boxes installed concealed in walls or ceiling areas shall be galvanized or cadmium plated sheet steel of not less than the minimum size as recommended in the National Electrical Code and shall be furnished with appropriate covers as specified in other applicable sections of these specifications or on the drawings. All boxes shall be accessible for maintenance purposes.

C. Exact locations of all floor boxes shall be coordinated in the field with the architect unless specific dimensions are shown on the drawings. Also, see Section 16500 of these specifications.

D. Surface Mounted. Fixture, outlet, and switch boxes installed surface mounted in plant, shop, operating, and unfinished areas shall be threaded, cast alloy iron or malleable iron. Iron type shall have a cadmium/zinc electroplate, or galvanized finish with appropriate lacquer. Boxes shall be of the approved type for the outlets, switches, and fixtures served and shall be made of the material and finish compatible with the conduit system and location. Surface mounted boxes shall be only as noted on the plans.

E. Splice and Tap Boxes. Splice and tap boxes for power circuits shall be used only where designated on the drawings and shall be of the type and size indicated. Otherwise all power wiring shall be continuous, splice and tap free, between equipment. On lighting and

convenience receptacle circuitry, wiring may be spliced and boxes shall be provided for concealed or surface mounting as previously specified or may be JIC oil-tight of size and type indicated on the drawings or minimum size as specified in the National Electrical Code.

F. Pull Boxes. Pull boxes for interior, or outdoor exposed power wiring shall be provided where shown or required to facilitate the installation of the wiring. Pull boxes shall not be located in finished rooms and shall be accessible for maintenance use. For conduit sizes 3/4 and 1 inch, conduit fittings of the "C", "LB", "TB" and similar types may be used for "Pulling In." Unless designated otherwise, all pull boxes shall be the straight-through type and changes in direction shall not be made in the box. The boxes shall be of the minimum size and type as required by the National Electric Code or as sized on the drawings.

G. Exterior and Underground. For exterior exposed work, pull boxes shall be of NEMA 3R construction and shall be threaded hub type with gasketed cover.

2.8 COVERS AND DEVICE PLATES

A. Contractor Furnished. The contractor shall furnish and install the appropriate cover on all boxes, conduit fittings, panels, cabinets, switches, receptacles, and similar wiring devices and other equipment that is Contractor furnished. Conduit outlet fitting covers shall be the type specified under "Conduit Fittings."

2.9 ENCLOSURES

A. Enclosures and housings for all Contractor furnished electrical equipment and devices shall be suitable for the location and environmental conditions and shall be of NEMA type as shown on symbol sheet drawing.

END OF SECTION 260501

SECTION 260519 — CONDUCTORS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this Section shall comply with all applicable requirements of SECTION 260500, GENERAL PROVISIONS.

1.2 SCOPE

A. This specification covers the requirements for all wire and cable to be used in the installation of the electrical systems for the project, including all power, lighting, control and instrumentation systems.

B. Wire and cable will normally be furnished by the Contractor for installation. Drawings will indicate where cable is not to be furnished.

C. All cable is to be "Contractor-furnished", the Contractor shall submit for approval by the Owner any deviations anticipated or proposed with respect to the cable manufacturer, cable type, or specification contained herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All wire and cable shall be Underwriters' Laboratories (UL) listed. In addition to other standard labeling, all wire and cable shall be marked UL on the outer surface indicating Underwriters' Laboratories, Inc. certification.

B. Grounding conductors, where insulated, shall be colored solid green. Conductors intended as a neutral shall be colored solid white.

C. For all circuits 600 volt and less, wires and cables shall have code grade, 600 volt type THWN-2, THHN, or XHHW-2 90 degrees C., wet or dry locations, moisture and heat resistant thermoplastic insulation. Insulation thickness shall be per National Electrical Code, Table 310-13.

D. Conductor sizes are expressed in American Wire Gage (AWG) or in circular mils. Conductors shall be annealed copper wire, minimum size #12 AWG, except that #14 AWG may be used for control. All conductors shall be stranded except that solid conductors may be used for #12 AWG lighting and receptacle branch circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Separation of Usage. Lighting and power wiring shall be routed in conduits, or other raceways as shown on the drawings. Lighting and power wiring shall not be routed in a common raceway except where shown on drawings. Push-button wiring shall be routed in separate raceways even though related to a particular motor circuit.

B. Pulling. Where mechanical assistance is used for pulling conductors, patented wire pulling compounds having inert qualities that do not harm the wire insulation or covering shall be applied to the conductors as they are pulled into raceways. Interior of all raceways shall be free from grease, filings or foreign matter before conductors are pulled in.

3.2 IDENTIFICATION

A. Wire, Cable, Raceways, and Conduits.

B. Circuit identification numbers shall be placed on each end of the conductor involved by using self-laminating marker tags, T&B Company E-Z Code Type WSL or equal. Circuit numbers shall be as shown on the plan and panel schedule drawings.

C. Phase Identification. Phase sequence throughout the installation shall be standardized wherever practical in all electrical power equipment as follows:

	Phase A	Phase B	Phase C
Position Occupied	Front	Center	Rear
	Top	Center	Bottom
	Left	Center	Right
Color Code: 208/120V, 3-phase	Black	Red	Blue

3.3 SPLICES AND TERMINATIONS

A. Lighting Conductors. Splices in lighting conductors shall be made with splicing caps with metal inserts only, such as 3M Company's "Scotchlock" spring connectors. The splices shall be firmly and neatly taped to prevent entry of moisture.

B. Power Conductors shall be continuous from outlet to outlet. No power cable shall be spliced except on explicit instructions of the Owner’s Representative.

3.4 LUGS

A. All lugs shall be furnished and installed by the Contractor where required.

B. Lugs for copper power wiring, Sizes No. 12 and No. 10 AWG, shall be T&B "Sta-Kon" uninsulated ring type lugs. Lugs for copper power wiring from No. 10 AWG to size 1/0 AWG shall be T&B 1-hole Type 54100 Series. Size 2/0 AWG and larger lugs shall be 2-hole type 54200 series (except where 1-hole is required to match motor lead lugs). Sizes above 1/0 are to be applied using hydraulic pump tool.

C. Where motor leads are furnished without lugs, T&B 54500 Series 2-way connectors (splicing sleeves) shall be used. Splice sleeves may be desirable where limited space for termination exists.

D. The proper lugs will normally be furnished with equipment in all Owner-furnished equipment. All other lugs shall be furnished and installed by the Contractor. No mechanical type lugs shall be used except in panelboards. If any mechanical type lugs are furnished with Owner-furnished equipment, the Contractor shall replace them with proper compression type lugs where practical.

3.5 TAPING

A. All voids, sharp corners and bolt projections shall be made smooth by filling with Okonite or Scotch Fill before applying the laps of tape required for insulation. All loose strands of wire shall be removed before taping. Duxseal will not be permitted.

B. Joints and other sections of wiring requiring tape shall be half lap and at least two layers. Taping shall be neatly done and shall form a permanent insulation equal in mechanical and electrical strength to the insulation of the conductor. Taping shall be as follows:

1. 600 Volt insulation - A minimum of 1-1/2 lap layer varnished cambric and 2-1/2 lap layers of 3M No. 33 vinyl plastic electrical tape.

C. All taping, splicing and termination materials shall be furnished by the Contractor.

END OF SECTION 260519

SECTION 260526 — GROUNDING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this Section shall comply with all applicable requirements of SECTION 260500, GENERAL PROVISIONS.

1.2 WORK INCLUDES

A. As Required By the NEC. In general, fixtures, outlets, the enclosing cases, mounting frames, etc., of all switches, circuit breakers, control panels, motors and any other electrically operated or electrical equipment, conduit, trays, and other raceways shall be effectively and permanently grounded with a separate copper grounding conductor of cross-section as required by the National Electrical Code and drawings. It shall be of capacity sufficient to ensure continuity and continued effectiveness of the ground connections to carry fault currents. Ground conductors must be as short and straight as possible, protected from mechanical injury and if practicable without splice or joint. The grounding conductor shall be run from a ground established at the source of supply to the equipment to be grounded. All grounding conductors shall be copper.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Power Conductors Supplying Equipment. A copper grounding conductor must be run inside the conduit or raceway, enclosing the power conductors supplying the equipment, or in case of a multi-conductor power cable, must be located within the sheath.

B. Connect at Source. Ground conductors in power cable or ground wire in conduits shall always be connected directly to station ground at the source end, and to motor frame or equipment enclosure and/or equipment ground bar.

C. System Neutral. The equipment grounding conductor in all circuits shall be connected to the frame and ground lug in the panelboards and not the neutral bus. Equipment ground connections to a system neutral are not permitted.

D. Fuses. In all cases of grounded circuits, fuses must be omitted from the grounded neutral conductor throughout the entire installation.

E. Equipment Frames. Frames of all electrical apparatus will be connected to the grounding system. Neutrals of service transformers shall be connected to the grounding system.

F. Metallic Raceways. All metallic conduits and wiring channels must be connected at each end to the grounding conductor with a good electrical contact.

G. Identification. The grounding conductor shall be stranded and covered with a green jacket.

H. In all cases the white wire should be used for the current-carrying neutral only and never as a grounding conductor, or other purpose.

END OF SECTION 260526

SECTION 260539 — ELECTRICAL RACEWAYS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this Section shall comply with all applicable requirements of SECTION 260500, GENERAL PROVISIONS.

1.2 SCOPE

A. Contractor Furnished. The contractor shall provide all conduit, fittings, and supports required and not otherwise shown on plans as furnished by others.

B. The types of electrical raceways required for the project include the following:

1. Electrical Metallic Tubing
2. Intermediate Metal Conduit
3. Flexible Metal Conduit
4. Liquid-Tight Flexible Metal Conduit
5. Rigid Galvanized Conduit
6. PVC Rigid Conduit

C. Type MC Cable is not allowed.

D. The minimum raceway size shall be 3/4".

E. Product Delivery, Storage, and Handling. Contractor is to provide color-coded end-cap thread protectors and handle conduit and tubing carefully to prevent damage. Store pipe and tubing inside whenever possible. When necessary to store outdoors, elevate well above grade and enclose with durable, watertight wrapping.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Electrical Metallic Tubing. Galvanized, thin wall tubing, fittings shall be hex-nut, expansion gland type, zinc plated, and U.L. listed as "raintight." No crimp, spring, or set-screw type fittings will be accepted.

B. Intermediate Metal Conduit. Galvanized steel tubing, with zinc coated interior.

C. Flexible Metal Conduit. Galvanized single steel strip, flexible, interlocked.

D. Liquid-Tight Flexible Metal Conduit. Galvanized single steel strip, flexible, interlocked, double wrapped, with liquid-tight PVC jacket.

E. Rigid Galvanized Conduit. Rigid steel, hot-dipped galvanized conduit.

F. PVC Rigid Conduit: U.L. listed Schedule 40 heavy wall rigid conduit.

G. Conduit, tubing and duct accessories including straps, hangers, expansion and deflection fittings as recommended by conduit, tubing, and duct manufacturers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Electrical Metallic Tubing. Branch circuits run in hollow dry walls and above ceilings. Not to be exposed.

B. Flexible Metal Conduit. Connection of motors and for other electrical equipment where subject to movement and vibration and located in a dry, interior location. Flexible conduit is not to exceed 60" in length for any one application.

C. Liquid-tight Flexible Metal Conduit. Connection of motors and for other electrical equipment where subject to movement and vibration, and also subjected to one or more of the following conditions: Exterior location; moist or humid atmosphere where condensate can be expected to accumulate; corrosive atmosphere; subjected to water spray; subjected to dripping oil, grease or water. Flexible conduit is not to exceed 60" in length for any one application.

D. Intermediate Metal Conduit. All conduits of 2" nominal trade size or more and/or where exposed. Not to be stubbed up at floor level.

E. Rigid Galvanized. Where specified on plans for certain underground or exposed runs, or where stubbed up at floor level.

F. Rigid PVC. Where specified on plans for certain underground runs, UL approved Schedule 40 heavy wall rigid PVC conduit shall be used. Not to be stubbed up at floor level. All PVC underground runs shall transition to rigid galvanized before stubbing up through floor slab or grade.

3.2 INSTALLATION

A. Install conduit and tubing in accordance with NEC and National Electrical Contractors Association's "Standard of Installation", and with recognized industry practices. Where NECA and NEC standards differ, use the more stringent requirement.

B. Complete the installation of raceways before starting installation of wires.

C. Wherever possible, install horizontal raceway runs above water and steam piping.

D. Care shall be taken to keep the interior of conduits clean, and each conduit run shall be thoroughly cleaned and dried before any cable is pulled through.

E. Unless indicated otherwise on drawings, all exposed conduits shall be run parallel with or perpendicular to building structural members.

F. Conduits entering sheet metal enclosures shall be made up with double locknut and insulating bushing. Locknut shall be of the type which will bite into the metal of the box.

G. Conduits entering threaded openings in equipment enclosures, boxes, etc., shall have at least five full threads engaged. In outdoor and underground locations, threaded joints shall be made up with a thin application of conducting joint compound. The inside of the fitting shall be thoroughly cleaned of any excess compound.

H. Power operated bending machines shall be used on conduits 1-1/4" and larger. Heating with torches will not be permitted.

I. All conduit runs shall be continuous from outlet to outlet with all joints and connections pulled tight to insure an electrically continuous and mechanically secure raceway system.

J. All raceways in "finished areas" such as offices, corridors, etc., shall be concealed.

3.3 CONDUIT AND TRAY OPENINGS

A. Contractor's Responsibility. The Contractor shall be responsible for all sleeves and openings through walls and floors necessary for passage of electrical conduits and raceways. Where contractor must provide openings and/or drill concrete floors and/or walls, he shall be responsible for the repair of these openings. Structural members and reinforcing shall not be cut, burned or damaged in any way. All openings in walls and floors, and under switchgear and panels where electrical cables and conduits are installed, shall be closed up by the Contractor to prevent dust, dirt and water from entering.

B. Sealing. The Contractor shall be responsible for sealing all wall and floor openings and all floor and wall sleeve openings utilized by the contractor whether furnished by Others or by the Contractor.

C. Sleeves and openings shall be sealed with materials that will withstand fire and heat to the same rating as the wall, floor, or ceiling through which the conduit or tray passes and shall not be less than a 30-minute barrier.

END OF SECTION 260539

SECTION 265107 — ELEVATOR INSTALLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Materials specified in this Section shall comply with all applicable requirements of SECTION 16010, GENERAL PROVISIONS.

1.2 WORK INCLUDES

A. The Contractor shall provide electrical connections required for the operation of the passenger elevator. The Contractor shall provide all disconnects, fuses, wire and conduit including but not limited to each controller feeder, lights and signal power disconnect, telephone service from each controller to the telephone board. Contractor shall provide required wiring from lobby shaft and machine room detectors to the elevator controller for Fireman's Recall. The system shall comply with NEC, NFPA and ANSI A17.1.

B. Equipment connections and cabling provisions are related to the design criteria for the specified elevator. Elevator wiring requirements vary between manufacturers for location of equipment and sizes of motor. Design requirements shall be verified and accommodated by the contractor for the actual elevator installed.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Components of wiring system shall comply with other sections of Division 16.

B. Controllers shall be furnished and installed under other divisions of these specifications.

C. The Contractor shall furnish and install all disconnect switches and fuses required for operation of the elevators.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall confirm all equipment locations in field with Installer prior to mounting of any equipment. All locations indicated are approximate.

B. Contractor shall confirm all equipment fuses and feeder ratings. Disconnect and feeder sizes are based on design criteria for bidding purposes. Exact fuse and feeder requirements shall be determined by the Contractor and provided per actual equipment furnished.

C. Contractor shall provide wiring systems and connections from source to disconnect and on to controller. Provide 3/4"C with pull string with telephone service from each controller to telephone board.

D. Provide elevator installer with temporary power, if necessary, sufficient to testing of elevator prior to permanent power installation.

E. Coordinate with elevator installer for required testing.

END OF SECTION 265107

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes LED luminaires per plan fixture schedules:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
2. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Provide Photometric layouts where requested on schedule, or for any proposed substitution.

C. Sustainable Design Submittals:

D. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

C. Product Certificates: For each type of luminaire.

D. Product test reports.

E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP 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, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

B. Ambient Temperature: 5 to 104 deg F.

1. Relative Humidity: Zero to 95 percent.

C. Altitude: Sea level to 1000 feet.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. California Title 24 compliant.

G. All fixtures supplied shall comply with IEEE 1789 flicker mitigation recommended practice.

H. Fixtures shall be provided with integral surge suppression device.

2.3 CYLINDER

2.4 MATERIALS

A. All fixtures shall be as listed on plan schedules and shall be UL listed and DLC certified.

B. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

C. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

D. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A240/240M.

E. Galvanized Steel: ASTM A653/A653M.

F. Aluminum: ASTM B209.

2.5 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" 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 luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 270500 — TELECOMMUNICATIONS RACEWAY SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general requirements of the Contract, including all Division 1 specification sections, apply to work specified in this section.

1.2 WORK INCLUDES

A. Description of Work: This section includes furnishing all labor, materials and equipment for the installation of the telecommunications raceway system for this project.

B. Contractor shall provide an empty raceway system including outlet boxes for the installation of telecommunications required for the project. Conduit shall be provided from phone outlet box locations to telephone board, as noted on plans. Conduits terminating at telephone boards shall have bushings to protect exiting cables. Conduits shall be run concealed where possible above ceilings, in attic, or inside walls, and where not possible, surface raceway shall be utilized.

C. Owner's telephone system installer shall install all cable, connection boards, outlet devices and connections to existing systems.

D. Electrical Contractor shall coordinate with Owner and cabling installer for scheduling of telecommunications system installation.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Outlets: All wall outlet boxes shall be 4" Sq. x 1-1/2" D boxes flush mounted 18" above finished floor (or 6" above counter tops) and having single gang extension rings. Wall phone outlets shall be 54" above finished floor.

B. Conduits: All raceways shall have nylon pullcable installed and left in place for telecommunications installer's use. Conduits shall comply with Section 16110 of the specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Raceway Installation: The telephone raceway's installation shall comply with Section 16110 of the specifications.

B. Outlets: Outlets and appropriate covers shall be supplied by Owner's telephone installer. Blank, 302 stainless steel covers shall be installed on any unused outlet by installer.

END OF SECTION 270500

SECTION 283111 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire alarm systems and components. The addition of the elevator tower requires additional fire alarm devices to include elevator recall functions and additional notification devices. The existing Cerberus panel will be required to be replaced with a new Cerberus XLS panel. The new panel shall be backwards compatible with the existing components in the building.

B. Definitions:

1. FACP: Fire alarm control panel.
2. LED: Light-emitting diode.
3. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

C. System Description:

1. Noncoded, addressable system; horn strobe, multiplexed signal transmission dedicated to fire alarm service only.

D. Performance Requirements:

1. Comply with NFPA 72.
2. Fire alarm signal initiation shall be by one or more of the following devices:

    a. Manual stations.
    b. Heat detectors.
    c. Smoke detectors.

3. Fire alarm signal shall initiate the following actions:

    a. Alarm notification appliances and speakers shall operate continuously.
    b. Identify alarm at the FACP.
    c. Transmit an alarm signal to the remote alarm receiving station.
    d. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
    e. Record events in the system memory.

4. Supervisory signal initiation shall be by one or more of the following devices or actions:

    a. Operation of a fire-protection system valve tamper.

    b. Kitchen hood suppression systems via relay monitoring module.

5. System trouble signal initiation shall be by one or more of the following devices or actions:

a. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
b. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
c. Loss of primary power at the FACP.
d. Ground or a single break in FACP internal circuits.
e. Abnormal ac voltage at the FACP.
f. A break in standby battery circuitry.
g. Failure of battery charging.
h. Abnormal position of any switch at the FACP or annunciator.

6. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP. Record event.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
2. Device Address List: Coordinate with final system programming.
3. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
4. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Wiring diagrams shall be specific to this project and to include all existing devices throughout the building. Show wiring color code.
5. Batteries: Size calculations to include existing and new devices.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

F. Documentation:

1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner. Format of the written sequence of operation shall be the optional input/output matrix.

a. Hard copies on paper to Owner.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. FACP and Equipment:

a. Cerberus XLS

2. Wire and Cable:

a. Comtran Corporation.
b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
d. West Penn Wire/CDT; a division of Cable Design Technologies.

3. Audible and Visual Signals:

a. Gentex Corporation.
b. System Sensor; a GE-Honeywell Company.
c. Wheelock, Inc.
d. All devices shall be compatible with the new Cerberus panel.

2.2 FACP

A. General Description:

1. Modular, power-limited design with electronic modules, UL 864 listed.
2. Addressable control circuits for operation of mechanical equipment.
3. Voice Evacuation type with recordable EPROM chip for up to 4 messages and with handset at main panel and remote annunciators.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision.

Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two line(s) of 80 characters, minimum with handset for paging across speaker/strobes.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Signaling Line Circuits: NFPA 72, Class A, Style 6.

   a. System Layout: Install no more than 50 addressable devices on each signaling line circuit.

2. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
3. Actuation of alarm notification appliances, annunciation, elevator recall, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
3. Record events.
4. Sound general alarm if the alarm is verified.
5. Cancel FACP indication and system reset if the alarm is not verified.

E. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41; however, in buildings such as health care facilities and prisons where the planned action during a fire is to relocate the occupants to a safe area within the building, the notification appliance shall sound in a 60 beats per minute, march-time pattern subject to the approval of the authority having jurisdiction.

F. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

G. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

H. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."

K. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.

1. Batteries: Sealed, valve-regulated, recombinant lead acid.
2. Battery and Charger Capacity: Comply with NFPA 72.

L. Surge Protection:

1. Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 16 Section "Transient Voltage Suppression" for auxiliary panel suppressors.
2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

M. Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 MANUAL FIRE ALARM BOXES

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, breaking-glass or plastic-rod type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
2. Station Reset: Key- or wrench-operated switch.

2.4 SYSTEM SMOKE DETECTORS

A. General Description:

1. UL 268 listed, operating at 24-V dc, nominal.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
3. Multipurpose type, containing the following:

    a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
    b. Heat sensor, combination rate-of-rise and fixed temperature.

4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.003 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:

    a. Sensor: LED or infrared light source with matching silicon-cell receiver.
    b. Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.003 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

2. UL 268A listed, operating at 24-V dc, nominal.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station for duct detectors mounted above ceilings and other locations which are out of sight.
7. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
8. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 HEAT DETECTORS

A. General: UL 521 listed.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) per minute, unless otherwise indicated. The fixed temperature and rate-of-rise temperature shall be selectable at the FACP.

1. Mounting: Adapter plate for mounting on 4” x 4” outlet box.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.

C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output: Comply with candela requirements of the current NFPA 72 and Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities.

2.7 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and/or a circuit-breaker shunt trip for power shutdown.

2.8 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled according to UL 632.

B. Functional Performance: Verify compatibility with the Owner’s alarm receiving station. Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal

indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.9 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer, but not less than No. 18 AWG.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 14 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Prior to beginning work, provide a complete testing of the existing system. Document any devices that fail to operate correctly. Document reporting of the system to the campus reporting agency. Provide complete drawings of system panel and device locations that can be utilized by the contractor in providing submittal for panel replacement and additional devices as required for the elevator.

B. Inspect existing wiring. Report any discrepancies to Engineer.

C. Wiring for new devices required for the elevator addition shall be run separately back to new panel, isolated from existing wiring.

D. Provide cabinet enclosure for documentation for NFPA 72 at FACP.

E. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

G. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

3.2 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

B. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Electrical Raceways."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Basic Materials."

B. Install instructions frame in a location visible from the FACP.

C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters.
3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
4. Testing: Follow procedure and record results complying with requirements in NFPA 72.

    a. Detectors that are outside their marked sensitivity range shall be replaced.

5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 72.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices.

3.7 RECORD DOCUMENTATION

A. Record Drawings: Provide Owner with a redline copy of all changes made during construction to original design.

B. Provide Owner with Operations and Maintenance manuals prior to close out with manufacturer’s data and equipment cut sheets. Owner’s maintenance responsibilities and a copy of all testing, NFPA reports and final programming of the system, in compliance with NFPA 72; 4.5.2.3. Provide copy of warranty with date of system energization.

END OF SECTION 283111

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 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 site utilities.
7. Temporary erosion and sedimentation control.

1.2 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

B. Surplus soil material shall be placed on site as dictated by Owner.

1.3 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. Traffic control shall be provided along E Cameron Ave as required. Traffic control shall not interfere with DPW operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "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. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed.

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. Protect trees and plants remaining on-site according to requirements.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

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

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots larger than 3 inches (75 mm) in diameter, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
2. Use only hand methods or air spade for grubbing within protection zones.

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 to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove 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 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.4 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrowed soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Initial Backfill: Place and compact initial backfill of subbase materials, free of particles larger than 1 inch in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.
2. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.

B. Related Requirements:

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the North Carolina Department of Transportation (NCDOT).

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NCDOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

B. Fine Aggregate: **ASTM D,** sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

C. Mineral Filler: ASTM D 242/D 242M, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Shall conform with NCDOT requirements.

B. Tack Coat: Shall conform with NCDOT requirements.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

2.4 MIXES

A. Recycled Content of Hot-Mix Asphalt: Shall conform to NCDOT requirements.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by NCDOT and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: I-19.0B.
3. Surface Course: S-9.5B.

PART 3 - EXECUTION

3.1 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.2 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Spread mix at a minimum temperature of 250 deg F (121 deg C).
2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.5 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 with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. 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.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.8 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving including the following

1. Granite Curbs.
2. Sloped walk.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of product, ingredient, or admixture requiring color selection. A sample of the granite curb will also be required.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.3 SHOP DRAWINGS

A. Granite Curb: Submit shop drawings for granite curb. Shop drawings to include dimensions, joint locations, finish and selection information.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars[; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating]. Cut bars true to length with ends square and free of burrs.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Cementitious Materials: Shall be in conformance with North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures, 2024 Edition.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

F. Water: Potable and complying with ASTM C 94/C 94M.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats].

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

B. Cementitious Materials: In accordance with NCDOT Standard Specifications. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: In accordance with NCDOT Standard Specifications.

C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

D. Concrete Mixtures: In accordance with NCDOT Standard Specifications.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M [and ASTM C 1116/C 1116M]. Furnish batch certificates for each batch discharged and used in the Work.

2.8 GRANITE CURB

A. Proposed mount airy granite curb (reinforced concrete edge restraint) shall have a sawn finish on the top, bottom and side. Curb shall be sawed to an approximate true plane with no projections or depressions greater than 1/8".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness[, to match jointing of existing adjacent concrete paving]:

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

B. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed paving surface with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 CONCRETE FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

1. Medium Brush Finish: In accordance with NCDOT Standard Specifications.

2. Sawn Finish: In accordance with NCDOT Standard Specifications.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing curing compound or a combination of these.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M) and the NCDOT Standard Specifications

3.10 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick Pavers

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product

B. Submit for architect's approval a test report and certificate of conformance for each type and color of brick specified on contracted documents.

C. Test reports shall include:
1. Compressive strength
2. Modulus of Rupture
3. 24-hour cold-water absorption
4. 5-hour boil
5. Saturation coefficient
6. Initial rate of absorption
7. Efflorescence
8. Weather classification
9. Paver type

D. Certificate of conformance shall state that brick meets or exceed applicable ASTM specifications indicated herein.

1.3 QUALITY ASSURANCE

A. Mockups for each form and pattern of unit paver.

B. All brick tests shall be performed by an independent certified testing laboratory.

C. All brick tests shall be in accordance with ASTM C67 latest edition.

1.4 MATERIALS

A. Brick Pavers: Red-flashed full range running bond brick pavement.

B. Edge Restraints: Brick stretcher course set in a concrete footing.

C. Curbs: Precast concrete and granite.

D. Grout: Job mixed, portland cement and sand.

E. Gravel: Gravel base materials for pedestrian and light vehicular traffic should be well graded conforming to ASTM D2940.

F. Geotextile Filter: Use Mirafi 700X geotextile fabric below sand bed to control fine sands from migrating into subgrade.

1.5 INSTALLATION

A. Joint Pattern: Match existing.

B. Aggregate Setting Bed:

1. Pavers set in a 1” polymetric sand setting bed.
2. 4” compacted aggregate base course over compacted subgrade.
3. Filter fabric between setting bed and compacted aggregate base course.
4. Pavers set with 1/16- to 1/8-inch (1.5- to 3-mm) sand-filled joints.

END OF SECTION 321400

SECTION 321713 - PARKING BUMPERS

1.1 SUMMARY

A. Concrete wheel stops.

1.2 INSTALLATION

A. Wheel stops anchored with galvanized-steel hardware and adhesive.

END OF SECTION 321713

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes painted markings applied to asphalt pavement.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Shall be in conformance with North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils. Apply paint so that it cannot run beneath the stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal. (0.72 kg/L).

END OF SECTION 321723

SECTION 329200 – TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Topsoiling.
2. Seeding.
3. Sodding.

1.2 DEFINITIONS

A. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

B. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

C. Topsoil: Natural, fertile soil capable of sustaining vigorous plant growth.

1.3 INFORMATIONAL SUBMITTALS

A. Certification of grass seed.

1. Certification of each seed mixture.

B. Product certificates.

1. Testing data for topsoil.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
2. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

a. Landscape Industry Certified Technician - Exterior.
b. Landscape Industry Certified Lawncare Manager.
c. Landscape Industry Certified Lawncare Technician.

3. Pesticide Applicator: State licensed, commercial.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Grass-Seed Mix:

1. Products: NCDOT seed mix as indicated on plans.

2.2 TURFGRASS SOD

2.3 FERTILIZERS

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 formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: [1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2.4 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

2.5 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.5 TOPSOIL

A. General: Topsoil shall be loamy sand, sandy loam, clay-loam, loam, silt loam, or other soil approved by the Engineer. It shall be natural, fertile soil capable of sustaining vigorous plant growth and shall be of a uniform quality, free from subsoil, slag, cinders, stones 1 inch or larger in any dimension, lumps of soil, sticks, roots, trash, or other extraneous, undesirable materials. Topsoil shall also be free of viable plants or plant parts of Bermuda grass, quackgrass, Johnson grass, nut sedge, poison ivy, Canada thistle, or similar material. The contractor shall have all topsoil tested by a reputable laboratory with resulting documentation submitted to the Engineer.

B. If testing reveals that the topsoil does not conform to the requirements of this section, the contractor shall be responsible for adjusting the ph range and/or percent of organic matter by means of approved additives.

C. Topsoil shall meet the following requirements:

1. ph range - 5.0 to 7.0.
2. Organic matter - four (4) percent (loss on ignition).
3. Soluble salts no higher than 500 parts per million.
4. Sieve Analysis:

Sieve Size	Percent Passing
1"	100%
½"	97%
#10	60-80%
#40	40-60%
#60	40-60%
#100	10-30%
#200	10-20%

D. When topsoil, stockpiled on site, is to be reused, soil debris to include roots, sods, stones, clay lumps, and other extraneous materials harmful to plant growth shall be removed prior to reuse.

E. Materials stripped from the following sources shall not be considered suitable for use as topsoil:

1. Soils having less than 4.1 ph value.
2. Chemically contaminated soils.
3. Areas from which the original surface has been stripped and/or covered over such as borrow pits, open mines, demolition sites, dumps, and sanitary landfills.
4. Wet excavation.

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

A. General: Prepare graded area for topsoil placement

B. Scarify the area to be topsoiled to improve the bond between slope and topsoil. Remove from the scarified area stones 2 inches or larger in any dimension and other debris such as wires, cables, tree roots, pieces of concrete, clods and lumps.

C. After the Engineer has approved the prepared surface elevations, spread topsoil and smooth to grade to produce the required thickness.

D. Ensure that ground areas are not damaged by the delivery, handling or storage of materials; by washouts due to drainage diversion; by workers; or by equipment. Repair such damage by grading, fertilizing, seeding and mulching as specified herein.

3.2 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h).

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket in loose thickness over seeded areas.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.3 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.4 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings.

3.5 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Engineer:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

4.0 QUANTITY AND PAYMENT

Separate payment will not be made for restoration of disturbed areas with topsoiling, fertilizing and seeding, but the cost shall be included in the various items of the proposal.

END OF SECTION 329200

SECTION 329201 – TEMPORARY SOIL EROSION & SEDIMENT CONTROL MEASURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Refer to Divisions 0 and 1 as they form a part of this Section.

B. This work shall consist of temporary control measures ordered by the Engineer during the life of the contract and as shown on plans, to control erosion and sediment through use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses and other erosion control devices or methods.

C. The primary objective of this specification is to control soil erosion to the maximum extent practicable commensurate with reasonable and economical construction practices.

D. The temporary control provisions contained herein shall be coordinated with the permanent erosion control features (grass, pavement and other restorations) specified elsewhere in the contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post-construction period.

E. The erosion control measures described herein shall be continued until the construction is complete and final restorations installed.

F. Wherever construction exposes work which is subject to erosion, the extent of such exposure in advance of the subsequent construction shall be subject to the approval of the Engineer. Erosion control features or other work to be completed within such areas shall follow as soon after exposure as practicable.

G. All materials and methods of construction shall be in accordance with the North Carolina State Standards for Soil Erosion and Sediment Control, and as depicted on the Soil Erosion and Sediment Control Plans.

H. Rolled erosion control products (nets, blankets or mats) must be free of plastic or synthetic materials, even if labeled "biodegradable" or "photodegradable". These products must be made with natural fibers, for example, jute (NOT "poly jute"), straw, sisal, or coir.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform to that depicted on the Soil Erosion and Sediment Control Plan.

PART 3 - EXECUTION

3.1 METHODS OF CONSTRUCTION

A. Preconstruction Conference

1. At the preconstruction conference or prior to the start of the applicable construction, the Contractor shall submit for acceptance his schedules for accomplishment of temporary and permanent erosion control work, as are applicable for excavation work, and any other elements of the project which may contribute to ground erosion of siltation. No work shall be started until the erosion control schedules and methods of operations have been accepted by the Engineer.

B. Construction Requirements

1. The Engineer has the authority to limit the surface area of erodible earth material exposed by excavation and grading operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams, water courses, or bodies of water. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion. Cut slopes shall be temporarily seeded and mulched as the excavation proceeds to the extent considered desirable and practicable.
2. The Contractor will be required to incorporate all permanent erosion control features to include the required pavement and grass restorations into the project at the earliest practicable times as outlined in his accepted schedule. Temporary control measures will be used to correct conditions that develop during construction that were not foreseen during the design stages that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
3. Where erosion is likely to be a problem, excavation and grading operations shall be so scheduled and performed that permanent erosion control features can follow immediately; otherwise temporary erosion control measures may be required between successive construction stages.
4. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal or state or location agencies, the more restrictive, laws, rules or regulations shall apply.
5. The Contractor will be responsible for maintaining all soil erosion and sediment control measures in an acceptable manner. All temporary measures shall be removed by the Contractor as directed by the Engineer.

END OF SECTION 329201

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Dielectric fittings.
3. Sleeves.
4. Identification devices.
5. Grout.
6. Piping system common requirements.
7. Equipment installation common requirements.
8. Concrete bases.
9. Metal supports and anchorages.
10. Sanitary sewer: ductile iron pipes, manholes, cleanouts, and service saddle.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. Cleanouts: A riser pipe off of a service line that provides access to the line for the purpose of line cleaning.

D. Sanitary Sewer: Exterior gravity or pressure public sanitary sewer systems.

E. Force Main: Pressure sanitary sewer systems.

F. Sewer Service: Exterior domestic sewer piping which connects to the public sewer system.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.
3. Sanitary sewer: ductile iron pipes, manholes, cleanouts, and service saddle.

a. Piping specialties.
b. Air & vacuum release valves and accessories.
c. Autodialers.
d. Sewage pumps and appurtenances, operating manuals.
e. Auxiliary generators.
f. Alarm devices.
g. Precast concrete manhole castings.
h. Piping paint.

B. Shop drawings.

C. Coordination drawings.

1. Show manholes and other structures in vicinity, pipe sizes and elevations, etc.

D. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

D. Ductile Iron Pipe Markings

1. Ductile Iron Pipe shall show on or near bell:
   a. Weight,
   b. Class or nominal thickness,
   c. The letters “DI” or “Ductile,”
   d. Manufacturer’s identifying mark,
   e. Year in which pipe was made, and
   f. Casting period.
   g. Steel pipe markings.

E. Design Standards

1. “Gravity Sanitary Sewer Design and Construction,” ASCE Manuals and Reports on Engineering Practice – NO. 60, WEF Manual of Practice NO. FD-5.

2. AWWA C600: Installation of Ductile-Iron Mains and Appurtenances.

3. NC Department of Environmental Quality, Division of Water Resources, NCAC Title 15A 02T Regulations, latest revision.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Hart Industries, International, Inc.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Div., or
g. Approved equal.

2. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.

a. Pressure Rating: 150 psig (1035 kPa) minimum at 180 deg F (82 deg C).
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Water Technologies, Inc., or
e. Approved equal.

2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.

a. Pressure Rating: 150 psig (1035 kPa) minimum.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Calpico, Inc.
b. Lochinvar Corporation., or
c. Approved equal.

2. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.

   a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
   b. End Connections: Threaded.

E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Perfection Corporation.
   b. Precision Plumbing Products, Inc.
   c. Victaulic Company; or
   d. Approved equal.

2. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

   a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
   b. End Connections: Threaded or grooved.

2.3 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.4 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: Accessible and visible.

B. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

D. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

F. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.

1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

H. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
1. Material: Valve manufacturer's standard solid plastic.
2. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
3. Shape: As indicated for each piping system.

I. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

J. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch (1.6 mm), unless otherwise indicated.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

K. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.6 DUCTILE IRON PIPES

A. Fittings shall be ductile iron at least class 54 thickness and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 for compact fittings. All ductile iron fittings shall have a minimum working pressure rating of 250 psi and minimum iron strength of 25,000 psi. All fittings shall be high alumina cement mortar lined in accordance with ANSI/AWWA C104/A21.4, fittings 6” and larger shall be lined with Protecto 401 or Novocoat SP-2000W and the outside shall be bituminous coated. The fittings shall be tested and the manufacturer shall provide certified test results when requested by OWASA. This testing shall include hydrostatic proof testing of fittings. Acceptable types of fittings shall be Mechanical Joint.

2.7 DUCTILE IRON FITTINGS

A. Ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA C151/ANSI A21.51 and ASTM A746, pressure class rated, class 350, unless otherwise approved by the OWASA Engineer. The thickness of Ductile Iron Pipe shall 02530 – SANITARY SEWER OWASA – Manual of Specifications, Standards, and Design Page 02530-9 July 2021 be determined by considering trench load in accordance with ANSI/AWWA C150/A21.50 (Public Sewers shall be no less than 8-inch diameter).

PART 3 - EXECUTION

3.1 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric unions.
2. NPS 2-1/2 (DN 65) and Larger: Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 (DN 65) and Larger: Dielectric nipples.

3.2 PIPING INSTALLATION

A. Install piping and sanitary sewer components according to the following requirements, Division 33 Sections specifying piping systems & OWASA Manual of Specifications, Standards, and Design.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

    a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.5 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.6 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
2. Locate pipe markers on exposed piping according to the following:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    d. At manholes and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.9 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.10 SANITARY SEWER DUCTILE IRON PIPES, MANHOLES, CLEANOUTS, AND SERVICE SADDLE

A. Pipe and fittings

1. Ductile iron pipe
   a. Gravity DIP shall conform to the same foundation and backfill requirements as those prescribed for water mains. Minimum laying length shall be 18 feet except for Tee/Wye connections or tie-in at a structure.

B. Manhole construction

1. Non-shrink grout shall be placed around pipe where pipe meets invert in manhole to provide for a smooth transition for sewage flow.
2. Manholes shall be installed plumb.
3. When applicable, during installation of manhole, if frame and cover is near or within wheel path in roadway, turn cone to place out of wheel path.

C. Cleanouts

1. Cleanouts may be used in lieu of manholes on 4 and 6-inch private lines with distances between cleanouts not exceeding 75 feet.

D. Service connections

1. Service saddles
   a. Service saddles shall be constructed using Romac Industries, Inc. sewer service saddles placed in the top quadrant of the pipe main. Backfill under and around saddle with #67 stone
2. Ductile iron service between cleanout and sewer main
   a. The lateral between the first upstream cleanout and the sewer main shall be ductile iron. Sewer laterals in road rights-of-way shall be ductile iron from the main to the first cleanout. Sewer laterals in easement are subject to vehicular traffic and must be ductile iron.

END OF SECTION 330500

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Cleanouts.
3. Trench drains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Submittal: Trench drain shall be submitted for review and approval prior to installation.

D. Product Certificates: For each type of pipe and fitting, from manufacturer.

E. Field quality-control reports.

1.4 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without [Architect's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Ductile Iron Sewer Pipe and Fittings: ASTM A746 or AWWA C151/A21.51.

2.2 CLEANOUTS

A. Cast Iron Cleanouts:

1. Description: DIP body with DIP threaded plug. Include DIP sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.3 TRENCH DRAINS

A. Trench Drains:

1. Ductile iron or stainless steel frame with integral anchoring.

2. Metal heel proof grate.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install 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.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
3. Install Ductile Iron sewer piping according to ASTM A746 or AWWA C151/A21.51.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 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 Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 TRENCH DRAIN INSTALLATION

A. Install trench drain with installation brackets for aligning and anchoring trench.

B. Install grate with locking toggle.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
b. Option: Test plastic piping according to ASTM F 1417.
c. Option: Test ductile iron piping according to ASTM A746 or AWWA C151/A21.51.

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.

END OF SECTION 334100

Geotechnical Exploration Report
Caldwell Hall Additions
The University of North Carolina at Chapel Hill
Chapel Hill, North Carolina
S&ME Project No. 24580077

PREPARED FOR:

The University of North Carolina at Chapel Hill
103 Airport Drive
Chapel Hill, North Carolina 27599

PREPARED BY:

S&ME, Inc.
8646 West Market Street, Suite 105
Greensboro, North Carolina 27409

March 29, 2024

March 29, 2024

The University of North Carolina at Chapel Hill
Caldwell Hall
240 E Cameron Avenue
Chapel Hill, North Carolina 27514

Attention: Ms. Nida DeBusk, NCARB, AIA, LEED AP

Reference: **Report of Subsurface Exploration Services**
Caldwell Hall Additions
The University of North Carolina at Chapel Hill
Chapel Hill, North Carolina
S&ME Project No. 24580077
NC PE Firm License No. F-0176

Dear Ms. DeBusk:

S&ME, Inc. (S&ME) has completed the subsurface exploration for the Caldwell Hall addition which is to be constructed on the UNC Chapel Hill campus in Chapel Hill, North Carolina. S&ME, Inc. The work was completed in general accordance with our proposal number 24580077 Revision 2, dated March 5, 2024. This report presents a brief summary of our understanding of the project, descriptions of our field exploration, a discussion of encountered subsurface conditions, and our conclusions and recommendations.

S&ME, Inc. appreciates the opportunity to provide geotechnical engineering services for this project. If you have questions or need additional information regarding this report, please call us at (336) 288-7180.

Sincerely,

S&ME, Inc.

Dylan Givens, P.E.
Project Engineer

John S. Scott, P.E.
Geotechnical Operations Manager

3/29/2024
Keith C. Brown, P.E.
Office Principal - Raleigh

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Appendices

1.0 Project Information

This report is based on the following information:

- An email from Nida Debusk, with UNC at Chapel Hill to John Scott with S&ME on February 6, 2024 through February 12,2024 with the following attachment(s):
  - *P1880 SK-03 UNC Caldwell Hall Geotechnical Investigation.pdf*
  - *UNC_CALDWELL HALL_GeotechBoundary_02152024.pdf*
  - *REID_CaldwellHall_Restrooms_01302024 marked by DMD.pdf*
  - *Site Plan Caldwell Hall marked by DMD.pdf*
  - *ME-2.6_Caldwell Hall Plans and Details_Feb2009.pdf*
  - *ME-2.6_Caldwell Hall Plans and Details_Feb2009.dwg*
  - *SU-2.4_Phase 2B Plan and Profile Caldwell and Carr_Feb2009.pdf*
  - *SU-2.4_Phase 2B Plan and Profile Caldwell and Carr_Feb2009.dwg*
  - *UNC_CALDWELL HALL_GeotechBoundary_03122024.pdf*
  - *Proposed Building Sections Drawing # A4.10.pdf*

We understand that a multi-story addition will be constructed on the west side of Caldwell Hall. The understood purpose of the addition is to add accessibility to the building with the installation of an elevator and enclosed stairwell. The extension will consist of a machine room and lobby on the ground floor and a restroom and lobby on the second floor. At this time, the structural loads for walls are unknown. Based on our experience, we anticipate the structural loads to be 5 kips per linear foot for the wall.

The west side of the building has an existing staircase with a concrete island connected to pavement and the southeast corner of the building has landscaping and pavement. Significant site grading is not anticipated.

1.1 Existing Site Information

The site is located south of East Cameron Ave and West of Emerson Drive. Site grades generally range from approximately 480 feet in the northeast portion of the site and increases towards the southwest to elevations of approximately 485 feet (Orange County GIS).

Figure 1-1 – Existing Site Conditions on March 12, 2024

2.0 Regional Geology

The Geologic Map of North Carolina (1985) indicates the area is located in the Piedmont Physiographic Province. The soils in the vicinity of the subject site have formed as a mantle of soil that has weathered in-place from the parent bedrock. These soils have variable thicknesses and are referred to as residuum or residual soils. The residuum is typically fine grained and has higher clay content near the surface because of advanced weathering. The soils generally become less clayey and sandier with depth because of less advanced weathering.

The boundary between soil and rock is not sharply defined. This transitional zone termed "partially weathered rock" is normally found overlying the parent bedrock. Partially weathered rock is defined for engineering purposes as residual material that can be penetrated by the drill rig augers and has standard penetration test blow counts in excess of 50 blows for six inches or less of sampler penetration. Weathering is facilitated by fractures, joints, and by the presence of less resistant rock types. Consequently, the profile of the partially weathered rock and hard rock is quite irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level. The presence of boulders floating within the soil matrix is common in the Chapel Hill area.

3.0 Field Exploration

Two soil test borings were performed by S&ME (labeled A-01 and A-02) as part of the site exploration activities. The approximate as drilled boring locations are indicated on the Boring Location Plan (Figure 2 in Appendix I). Boring locations were marked in the field by S&ME by referencing *UNC_CALDWELL HALL_ GeotechBoundary_03122024.pdf* and measuring off of existing features. Under the observation/approval of UNC Utility Locators, A-01 was offset approximately 3 feet South due to required clearance for the underground steam tunnel and approximately 2 feet East to provided clearance from overhead tree branches. A-02 was offset approximately 5 feet West due to site access constraints. The surface elevations for each boring were interpreted from Google Earth and should be considered approximate.

3.1 Soil Test Borings

Machine-drilled borings were conducted using a truck-mounted, CME 550 drill rig equipped with an autohammer. Hollow stem, continuous flight augers were used to advance the borings to termination depths ranging from 16.2 to 21.2 feet below existing grade. Standard Penetration Tests (SPT) were performed in the borings at 2.5-foot intervals in the top 10 feet, then at 5-foot intervals thereafter, in general accordance with ASTM D 1586 to provide an index for estimating strength parameters and relative consistency of subsurface soils.

Groundwater measurements were attempted after drilling was completed in each of the test borings. Upon completion of water level measurements, the boreholes were backfilled with auger cuttings, and were patched at the surface with asphalt cold patch at each boring before demobilizing the drill rig from the site.

Once soil samples retrieved from borings were received in our laboratory, a geotechnical staff professional visually examined each sample to estimate the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams, and apparent geological origin. The results of the classifications as well as the field test results are presented on the individual Boring Logs included in Appendix II. Similar soils were grouped into strata on the logs. The strata contact lines represent approximate boundaries between the soil types; the actual transition between the soil types in the field may be gradual in both the horizontal and vertical directions.

4.0 Subsurface Conditions

4.1 Surface Materials

A surficial layer of asphalt and associated base course, approximately 0.8 inches thick, was encountered at borings A-01 and A-02.

4.2 Fill Soils

Fill soils were encountered in boring A-01 to a depth of approximately 8 feet below surface elevation. Fill soils consisted predominantly of silty sand and lean clay (Unified Soil Classification SM and CL). Standard Penetration Test (SPT) N-values recorded in fill soils ranged from 8 to 11 blows per foot (bpf). Fill soils were visually observed to be moist. Typically, compacted existing fill with N-values on the order of 8 bpf or more indicate fill was placed

in a controlled manner and adequately compacted to a uniform minimum value. Therefore, we interpret that the existing fill was placed in a uniform, controlled manner.

4.3 Residual Soils

Residual soils were encountered below fill in A-01 and at a depth of approximately 0.8 feet in A-02. Residual soils were generally consisted of sandy silt, silty sand, and lean clay (Unified Soil Classification ML, SM, and CL). SPT N-values recorded in residual soils ranged from 5 to 15 blows per foot (bpf), with typical values ranging from about 5 to 10 bpf. Residual soils were visually observed to be moist.

4.4 Partially Weathered Rock and Auger Refusal

Underlying residual soils, partially weathered rock (PWR) was encountered at a depth of approximately 18.5 feet in borings A-02. Partially weathered rock is defined as a transitional material between very hard soil and rock which has a Standard Penetration Resistance value of at least 50 blows per 6 inches. This material may contain boulders and layers of relatively fresh rock.

Refusal material was encountered in borings A-01 and A-02 at a depth of approximately 16.2 and 21.2 feet below the existing ground surface. Refusal is a designation applied to any material having a resistance in excess of the penetrating capacity of the drilling equipment. Refusal may result from boulders, rock seams, or the upper surface of sound continuous rock. Rock coring drilling procedures are required to determine the characteristics and continuity of the materials below the level of refusal.

4.5 Groundwater

Groundwater measurements were attempted in borings at termination and were found to be dry above their boring cave depth. Refer to the individual boring logs and subsurface profile for hole cave depths.

Groundwater elevations can be expected to fluctuate due to seasonal variations in rainfall, evaporation, and other factors. Additionally, perched water conditions may exist during the typically wetter winter months above less permeable fine-grained soils, within existing fill soils and at the interface between overburden soils, fill and partially weathered rock.

5.0 Conclusions and Recommendations

The following sections provide our conclusions and recommendations regarding foundation support and development of the site. The following conclusions and recommendations are based upon the subsurface exploration data, understanding of the proposed construction, our previous experience with construction activity near this location, and from our experience with similar structures. If assumed structural loads, site grades, or structure locations are different from those indicated, we should be provided the opportunity to review and comment upon these recommendations.

When reviewing these recommendations, please remember that the site has been extensively developed in the past. Experience with previously developed sites indicates that unexpected conditions often exist. These may include active or abandoned utility lines, underground structures, poorly compacted fill, and others. These

conditions, if encountered, can best be handled by engineering evaluations made in the field. We recommend that a budget contingency be established for dealing with unexpected conditions that may be encountered.

5.1 Site Preparation

Site preparation in the building areas should consist of the removal of surface materials. This will include surface vegetation, organic-laden topsoil, roots, asphalt and pavement, crushed stone, and unstable near-surface soils. The exposed subgrade should be evaluated by a representative of the Geotechnical Engineer to confirm that unsuitable materials have been removed and underlying soils are sufficiently stable for new fill placement. If exposed subgrades are unstable, undercutting could be needed.

After evaluation and needed repairs are made, required fill should be uniformly applied in loose lifts with thicknesses of 6 to 8-inches and be compacted to at least 95 percent and the top 12 inches be compacted to at least 98 percent of the standard Proctor maximum dry density. If off-site borrow is used, it should meet the following:

- USCS classification of ML, CL, SP, SM, SC or some combination of these.
- Low plasticity soil (with a plasticity index less than 30%).
- A standard Proctor maximum dry density of at least 95 pounds per cubic foot.
- Maximum particle size of 2 inches in any dimension.
- Less than 3% organic content.
- Free of deleterious materials.

5.2 Foundation Recommendations

Minimum wall and column footing dimensions of 18 and 24 inches, respectively, should be maintained to reduce the possibility of a localized, punching-type shear failure. Exterior foundations and foundations in unheated areas should be designed to bear at least 18 inches below finished grade for frost protection and protective embedment.

After proper site preparation and fill placement (if needed), building foundations can be supported on shallow spread footings designed for an allowable net soil bearing pressure of 2,500 pounds per square foot (psf). This bearing pressure assumes that footings will bear in approved natural soils or well compacted structural fill, and that the site is prepared as recommended herein. This includes undercutting low-consistency soils, properly placing and compacting structural fill.

We recommend that a budget contingency be established for undercutting beneath footings. Both addition areas are underlain by previously placed fill soils. Borings indicate the fill is generally well compacted, our experience is that subsurface conditions are often erratic on previously developed sites. Footings should be evaluated by the geotechnical engineer or his representative. The evaluation should include performance of shallow hand auger borings with dynamic cone penetrometer (DCP) testing. If unsuitable soils are encountered, undercutting will be needed. Undercut areas can be backfilled with washed, crushed stone (#57 stone).

Care should be taken where new footings meet existing building footings. Existing footings should not be undermined. If undercutting of new footings is required near existing footings, this condition should be evaluated by the geotechnical and structural engineers.

If water collects in any excavations, it should be removed promptly. Care should be exercised during construction of foundations in order not to disturb bearing soils and reduce their bearing strength. Concrete for the footings should be placed as soon as practical following excavation. If concrete placement is delayed, placement of a concrete "mud mat" on exposed bearing soils should be considered.

5.3 Settlement

Based on conditions encountered by this exploration, anticipated structural loads, our current understanding of site grading and provided the site is prepared as recommended above, we expect that maximum total settlements beneath footings will be 1 inch or less. Differential settlements are expected to be ½ inch or less.

Care should be used during construction adjacent to the existing building, particularly during excavation. The loads from the new building can create some additional stresses beneath the existing foundations and potentially cause some settlement. Our experience indicates that this settlement should not adversely affect the performance of the structure. However, with any construction adjacent to an existing building, there is always the possibility that some small cracks could develop in masonry walls.

5.4 Temporary Shoring and Below Grade Walls

Temporary shoring, in this case for excavating next to adjacent underground utilities, and below-grade walls (elevator shaft wall) must be capable of resisting the lateral earth pressures that will be imposed on them. Below grade walls that are constrained and prevented from rotating at the top, such as elevator pit walls, basement walls, etc., should be designed for the at-rest earth pressure coefficient (Ko).

The method of temporary shoring should be left up to the contractor to determine which method is best for the application with respect to the site conditions and their experience and competency with each method. The shoring should be designed to prevent any movement of existing utilities or nearby structures due to the planned excavations. Temporary shoring should be designed with respect to the lateral earth pressures imparted by the existing soils on site while below grade walls of the elevator pit/basement should consider the lateral earth pressures imparted by the constructed backfill behind the walls.

Considering existing site conditions and reuse of the existing fill soils (ML, CL and SM soils) placed and compacted to 95 percent of its maximum dry density as determined by a standard Proctor test (ASTM D 698), we recommend the following design earth parameters:

Table 5-1: Lateral Earth Pressures

Parameter	Values for Utilities (Existing Soils)	Values for Elevator Pit (Compacted Fill)
At-Rest Earth Pressure Coefficient (K_o)	0.5	0.53
Active Coefficient Earth Pressure (K_a)	0.33	0.36
Passive Earth Pressure Coefficient (K_p)	3.00	2.76
Moist Unit Weight of Backfill (pcf)	115	110

We recommend an ultimate friction coefficient between wall foundations and bearing soils of 0.35 be utilized. We recommend below grade walls either be designed to resist transient hydrostatic pressure or drainage behind the wall be provided. Drainage may consist of a manufactured wall drainage product that would filter drainage from backfill soils. A perimeter foundation drain at the bottom of the wall is recommended to collect drainage. The drain should discharge to a reliable gravity outlet.

5.5 Seismic Site Classification

Based on a review of the performed soil test borings and our experience with similar soils in similar geologies and in accordance with Section 1613 of the North Carolina Building Code 2018 Edition (2015 International Building Code with North Carolina Amendments – ASCE 7-10) the Seismic Site Class is D. S&ME has included the below table which includes values which are applicable to the current North Carolina Building Code (ASCE 7-10) and the most up to date ground motions based on ASCE 7-16. The spectral design accelerations are presented in Table 5-2.

Table 5-2: Seismic Design Accelerations

ASCE Reference	Seismic Design Risk Category	Site Class	S_S	S_1	F_A	F_V	F_{PGA}	PGA_M	S_{DS}	S_{D1}	Seismic Design Category
7-10	I-III	D	0.158	0.078	1.6	2.4	1.6	0.118	0.169	0.125	B
7-10	IV	D	0.158	0.078	1.6	2.4	1.6	0.118	0.169	0.125	C
7-16	I-III	D	0.123	0.062	1.6	2.4	1.6	0.094	0.131	0.098	B
7-16	IV	D	0.123	0.062	1.6	2.4	1.6	0.094	0.131	0.098	C

6.0 Limitations of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

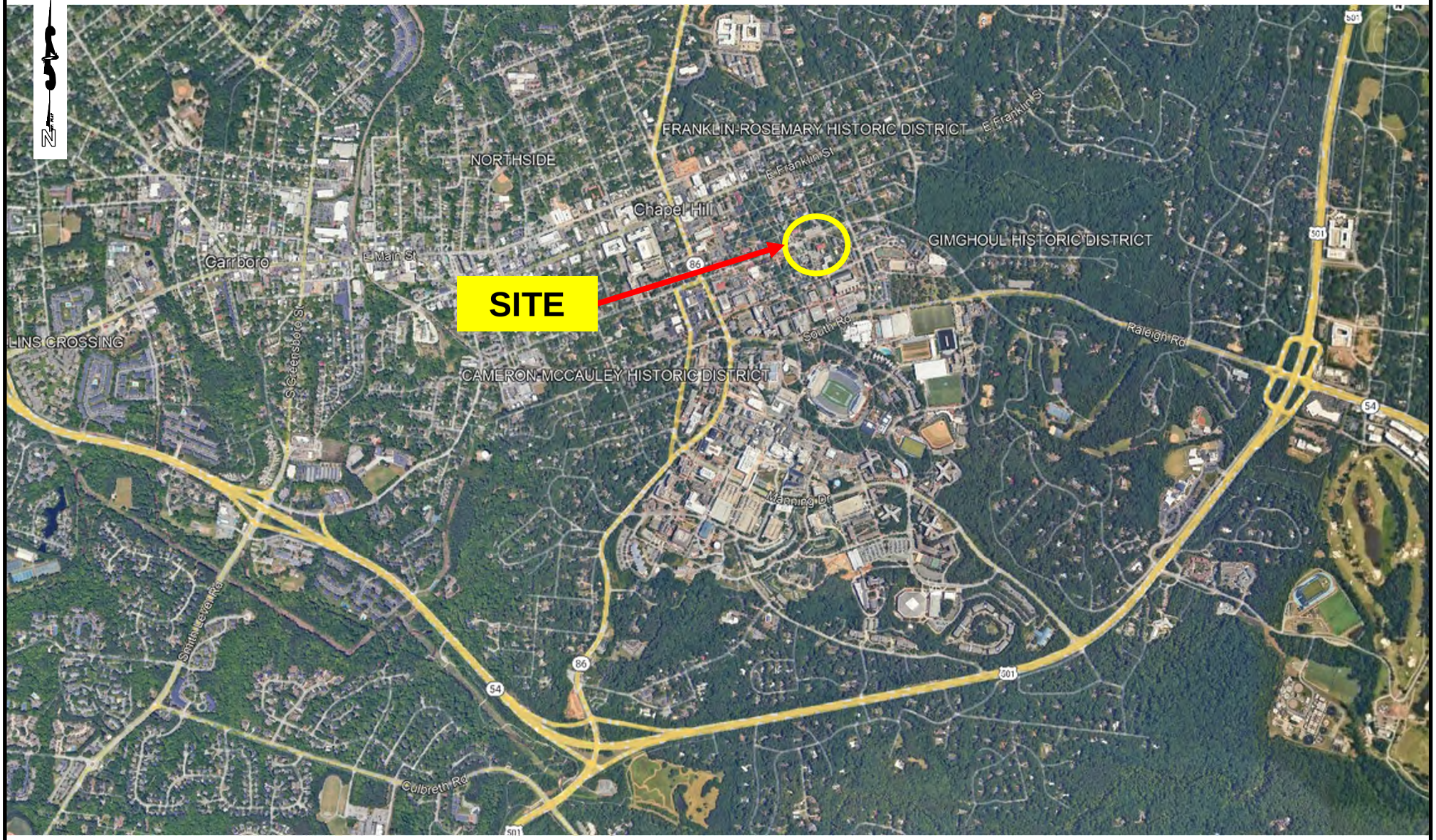
We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

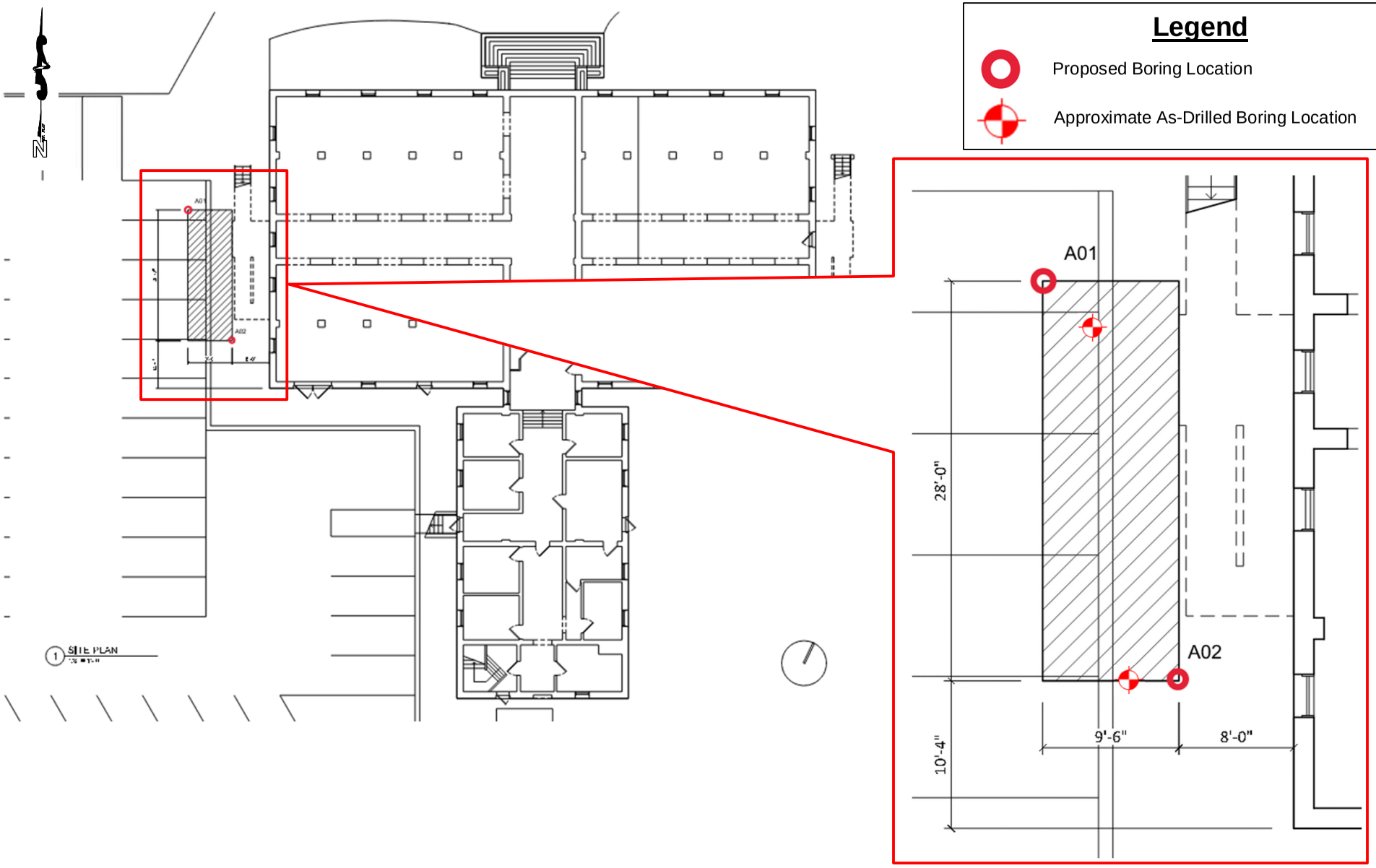
Appendices

Appendix I – Figures



NOTE:
THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

	Site Location Plan UNC - Caldwell Hall Additions Subsurface Exploration Services Chapel Hill, Orange County, North Carolina	JOB NO.: 24580077	FIGURE NO.: 1
		SOURCE: Google Earth	DRAWN BY: SAB
		DATE: March 2024	CHECKED BY: DRG



NOTE:
UNC_CALDWELL HALL_GeotechBoundary_03122024 HAS BEEN MODIFED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

Boring Location Plan

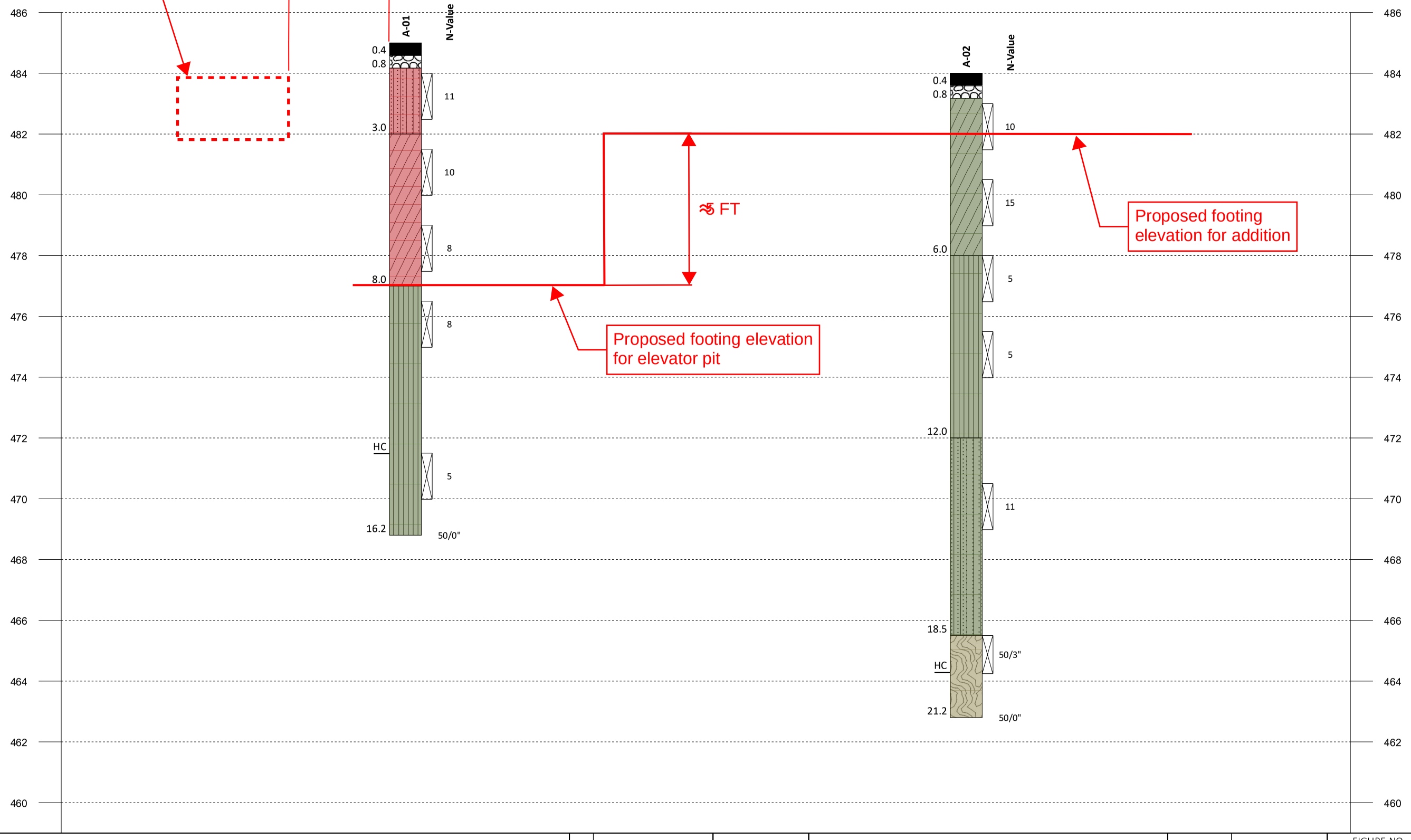
UNC - Caldwell Hall Additions
Subsurface Exploration Services
Chapel Hill, Orange County, North Carolina

JOB NO.: 24580077	FIGURE NO.: 2
SOURCE: Google Earth	DRAWN BY: SAB
DATE: March 2024	CHECKED BY: DRG

Approximate location of Steam Tunnel

≈8 FT

Locations and elevations were taken from *Proposed Building Sections, A4.10* dated 03/12/2024 and should be considered approximate



Legend Key

- Fill
- Residuum
- IGM/PWR
- Asphalt
- ABC
- SM
- CL
- ML
- PWR

459.00

The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface conditions will vary between boring locations.

▽	AT TIME OF DRILLING
▼	END OF DRILLING
▼	AFTER DRILLING

Generalized Subsurface Profile

UNC - Caldwell Hall Additions
Chapel Hill, North Carolina

SCALE:	Not to scale
DATE:	Mar 27, 2024
PROJECT NUMBER:	24580077

FIGURE NO. 3

Appendix II – Boring Logs

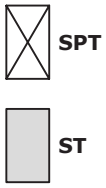
SOIL LOG LEGEND

SOIL PROPERTY SYMBOLS

N - Standard Penetration, bpf
LL - Liquid Limit, %
PPV - Pocket Penetrometer Value, tsf
NMC - Natural Moisture Content, %
PL - Plastic Limit, %
Qu - Unconfined Compressive Strength
F - Fines Content, %
PI - Plasticity Index, %
γd - Dry Unit Weight, pcf

The STANDARD PENETRATION TEST (SPT) as defined by ASTM D1586 (or AASHTO T206) is a method to obtain a disturbed soil sample for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D./2-inch O.D. split-barrel sampler is driven three 6-inch increments with a 140 lb. hammer freely falling 30 inches. The hammer can either be of a trip, free-fall design, or actuated by a rope and cathead. The SPT N Value is determined by adding the number of blows from the 2nd and 3rd 6-inch increments. A normalized blowcount (N_{60}) may be determined by the following equation: N_{60} = [Rig Energy Ratio (%) / 60] * N.

SHELBY TUBE (ST) samples are obtained by hydraulically pushing a thin-walled tube (typically 3-inches in diameter) to obtain a relatively undisturbed sample for testing of fine-grained soils to determine engineering properties such as strength, compressibility, permeability, and density. Shelby tubes are sampled in general accordance with ASTM D1587 (AASHTO T207).



Descriptive Order of Soil Strata: Geologic Disposition (i.e., Fill, Colluvium, Alluvium, etc.), ASTM Group Name (ASTM Group Symbol), quantified/qualified soil constituents, misc. constituents, consistency/density, color, organic description, moisture. ASTM group classifications is determined per ASTM D2487 where lab testing has been performed and ASTM D2488 where lab testing has not been performed.

ASTM GROUP NAME (SYMBOL) AND GRAPHIC

- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- WELL GRADED GRAVEL WITH SILT (GW-GM)
- WELL GRADED GRAVEL WITH CLAY (GW-GC)
- POORLY GRADED GRAVEL WITH SILT (GP-GM)
- POORLY GRADED GRAVEL WITH CLAY (GP-GC)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- CLAYEY GRAVEL WITH SILT (GC-GM)
- WELL GRADED SAND (SW)
- POORLY GRADED SAND (SP)
- WELL GRADED SAND WITH SILT (SW-SM)
- WELL GRADED SAND WITH CLAY (SW-SC)
- POORLY GRADED SAND WITH SILT (SP-SM)
- POORLY GRADED SAND WITH CLAY (SP-SC)
- SILTY SAND (SM)
- CLAYEY SAND (SC)
- CLAYEY SAND WITH SILT (SC-SM)
- LEAN CLAY (CL)
- SILTY CLAY (CL-ML)
- SILT (ML)
- FAT CLAY (CH)
- ELASTIC SILT (MH)
- ORGANIC LOW PLASTICITY SILT OR CLAY (OL)
- ORGANIC HIGH PLASTICITY SILT OR CLAY (OH)
- PEAT (PT)
- TOPSOIL
- ASPHALT
- BASE - CEMENT MODIFIED
- BASE - CEMENT STABILIZED AGGREGATE
- BASE - GRAVEL
- CONCRETE
- VOID / NO RECOVERY
- IGM / PWR

FINE-GRAINED SOIL (Relative Consistency)

	N	PPV
Very Soft	< 2 bpf	< 0.25 tsf
Soft	2 - 4 bpf	> 0.25 - 0.5 tsf
Firm	5 - 8 bpf	> 0.5 - 1.0 tsf
Stiff	9 - 15 bpf	> 1.0 - 2.0 tsf
Very Stiff	16 - 30 bpf	> 2.0 - 4.0 tsf
Hard	> 30 bpf	> 4.0 tsf

COARSE-GRAINED SOIL (Relative Density)

	N
Very Loose	< 5 bpf
Loose	5 - 10 bpf
Medium Dense	11 - 30 bpf
Dense	31 - 50 bpf
Very Dense	> 50 bpf

MINOR CONSTITUENTS (% By Weight)

	Percentage
Trace	0% - 10%
Little	11% - 20%
Some	21% - 35%
"And"	≥ 36%

ORGANIC CONTENT OF SOIL (Determined by ASTM D2974 or AASHTO T267)

Classification	Percentage
With Organic Matter	4% - 15%
Organic Soil	16% - 30%
Peat	> 30%

MOISTURE CONDITION

Dry	Absense of moisture, dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

At Time of Drilling (ATD) — Groundwater observation made anytime during the drilling process. Depending on time of reading and drilling methodologies, this value may be influenced by the drilling process.

End of Drilling — Groundwater measurement soon after the drilling processes are complete, and the borehole is at final depth. Drilling fluids, if introduced during drilling, may influence this measurement.

After Drilling — Groundwater measurements made in a borehole hours to days after drilling is complete. Depending on subsurface conditions, elapsed time, drilling process, etc. this observation may reflect a stabilized level.

REFERENCES:

FHWA NHI-16-072, Geotechnical Engineering Circular No. 5 "Geotechnical Site Characterization"
ASTM Specifications D2487 and D2488
DOT Specifications & Design Manuals from NC, SC, OH, MI, IN, PA, VA.

PROJECT:	UNC - Caldwell Hall Additions Chapel Hill, North Carolina S&ME Project No. 24580077	BORING LOG: A-01 *Sheet 1 of 1*
DATE DRILLED: 03/15/2024	**ELEVATION:** 485 ft	**NOTES:** Boring located in the field using UNC_CALDWELL HALL_ GeotechBoundary_03122024. Boring offset 3 feet South and 2 feet East due to underground steam tunnel and tree branch. Elevation interpolated from Google Earth and should be considered approximate.
DRILL RIG: CME 550	**DATUM:** NAVD88	
DRILLER: TJ, CW, WH	**BORING DEPTH:** 16.2 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Asphalt Patch	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Dylan Givens	**LATITUDE:** 35.912128 **LONGITUDE:** -79.049304
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								485
	0.4				ASPHALT, 5 inches			
	0.8				AGGREGATE BASE, 5 inches			
		Fill		SS-1	SILTY SAND (SM), medium dense, tan gray orange, fine to medium grained, moist, trace rock fragments, with clay nodes and seams	3-5-6 N = 11	●	
	3.0				LEAN CLAY (CL), stiff to firm, orange tan, moist			
				SS-2		3-4-6 N = 10	●	
5								480
				SS-3		2-4-4 N = 8	●	
	8.0				SANDY SILT (ML), firm, orange tan, fine grained, moist			
				SS-4		2-4-4 N = 8	●	
10		Residuum						475
	Hole Cave at 13.5 feet							
				SS-5		1-2-3 N = 5	●	
15								470
	Auger refusal at 16.2 feet			SS-6		50/0" N = 50/0"	●	
	16.2				Borehole terminated at 16.2 feet			
20								465

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	03/15/2024		Not encountered at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	UNC - Caldwell Hall Additions Chapel Hill, North Carolina S&ME Project No. 24580077	BORING LOG: A-02 *Sheet 1 of 1*

DATE DRILLED: 03/15/2024	**ELEVATION:** 484 ft	**NOTES:** Boring located in the field using UNC_CALDWELL HALL_ GeotechBoundary_03122024. Boring offset 5 feet West due to obstruction. Elevation interpolated from Google Earth and should be considered approximate.
DRILL RIG: CME 550	**DATUM:** NAVD88	
DRILLER: TJ, CW, WH	**BORING DEPTH:** 21.2 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Asphalt Patch	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Dylan Givens	**LATITUDE:** 35.912096 **LONGITUDE:** -79.049278
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0				ASPHALT, 5 inches		484
	0.4			AGGREGATE BASE, 5 inches		
	0.8		SS-1	LEAN CLAY (CL), stiff, brown gray red, moist	2-5-5 N = 10	
			SS-2		4-6-9 N = 15	
5						479
	6.0		SS-3	SANDY SILT (ML), firm, orange tan, fine to medium grained, moist, with clay nodes and seams	1-3-2 N = 5	
		Residuum	SS-4		2-3-2 N = 5	
10						474
	12.0		SS-5	SILTY SAND (SM), medium dense to very dense, red brown, fine to coarse grained, moist	4-4-7 N = 11	
15						469
	Hole Cave at 19.7 feet					
	18.5	PWR	SS-6	PWR, sampled as SILTY SAND (SM), red brown, fine to coarse grained, moist, with rock fragments	14-9-50/3" N = 50/3"	
20	Auger refusal at 21.2 feet					464
	21.2		SS-7	Borehole terminated at 21.2 feet	50/0" N = 50/0"	

STANDARD PENETRATION TEST DATA: △ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	03/15/2024		Not encountered at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial