DATE: July 14, 2017

PREPARED BY:
CMH Architects, Inc.

SPECIFICATIONS FOR

Merchant's Square- Parking Deck
Huntsville, AL
CMH Project # 1080.20

ISSUED FOR
Bid/ Construction Issue

CMH Architects, Inc.
1800 International Park Drive, Suite 300
Birmingham, AL 35243
(205) 969-2696
SECTION 00 0102 - PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. Project Name: Merchant's Square- Parking Deck, located at:
   Bob Wallace Avenue SW & Memorial Pkwy Access Rd.
   Huntsville, AL 35801.

B. The Owner, hereinafter referred to as Owner: City of Huntsville
   1. Address: 320 Fountain Circle.
   2. City, State, Zip: Huntsville, AL 35801.
   3. Phone/Fax: ________.
   4. E-mail: ________.

C. Owner's Project Manager: ________.
   1. Address: ________.
   2. City, State, Zip: ________.
   3. Phone/Fax: ________.
   4. E-mail: ________.

1.02 PROJECT DESCRIPTION

A. Summary Project Description: 1 elevated level precast parking deck with approximately 90 cars
   on the elevated level.

B. Contract Scope: Construction.

C. Contract Terms: Lump sum (fixed price, stipulated sum).

1.03 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as [ ]: CMH Architects, Inc.
   1. Address: 1800 International Park Drive, Suite 300.
   2. City, State, Zip: Birmingham, Alabama 35243.
   3. Phone/Fax: 205-969-2696 / 205-969-3930.
   4. Contact: Michael Tillman
   5. E-mail: mtilman@cmharch.com.

B. Structural Engineer: LBYD Engineering
   1. Address: 716 South 30th Street.
   2. City, State, Zip: Birmingham, AL 35233.
   3. Phone/Fax: 205-251-4500.
   4. Contact: Kevin Brown/Ashley Carden
   5. E-mail: kbrown@lbyd.com/acarden@lbyd.com.

C. Mechanical/Plumbing Engineer: BBGS Engineering Consultants
   2. City, State, Zip: Birmingham, AL 35242.
   3. Phone/Fax: 205-995-4979.
   4. Contact: John Bagby/Mike Streetman
   5. E-mail: jbagby@bbgs.pro/mstreetman@bbgs.pro.

D. Electrical Engineer: Hyde Engineering
   1. Address: 3120 8th Ave. South.
   2. City, State, Zip: Birmingham, AL 35233.
   3. Phone/Fax: 205.982.0900.
   4. Contact: Liz Hyde/Hannah Hyde
   5. E-mail: liz@hyde-egr.com/hannah@hyde-egr.com.
1.04 PROCUREMENT TIMETABLE
   A. Advertise for Public Bid July 19, 2017
   B. Pre-Bid Briefing: July 26, 2017 at 10:00 AM.
   C. Bid Due Date: August 3, 2017, before 10 AM local time.
   D. City Council meeting to approve issuing contract for project August 17, 2017
   E. Notice to Proceed August 18, 2017
   F. Required Final Completion Date: Not later than March 23, 2018.
   G. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
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PROCUREMENT AND CONTRACTING REQUIREMENTS

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00 0102 - Project Information
00 0107 - Seals Pages
00 0110 - Table of Contents
00 0115 - List of Drawing Sheets

Remaining Procurement and Contracting Information to be provided by City of Huntsville, AL

00 5000 - Contracting Forms and Supplements
00 7200 - General Conditions
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SPECIFICATIONS

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01 2300 - Alternates
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01 3100 - Contract Modification Procedures
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01 4000 - Quality Requirements
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01 5000 - Temporary Facilities and Controls
01 6000 - Product Requirements
01 7000 - Execution and Closeout Requirements
01 7419 - Construction Waste Management and Disposal
01 7800 - Closeout Submittals
01 7900 - Demonstration and Training

Division 02 -- Existing Conditions

02 3900 - Rammed Aggregate Piers

Division 03 -- Concrete

03 3000 - Cast-in-Place Concrete
03 4100 - Precast Structural Concrete

Division 04 -- Masonry

04 2000 - Unit Masonry

Division 05 -- Metals
05 5000 - Metal Fabrications
05 5100 - Metal Stairs
05 5213 - Pipe and Tube Railings
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07 6200 - Sheet Metal Flashing and Trim
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26 0544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABELING
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26 0573 - Coordination and Arc Flash Studies
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26 2416 - Panelboards
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SECTION 00 0115
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END OF SECTION
SECTION 00 5000 - CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 CONTRACTOR IS RESPONSIBLE FOR OBTAINING A VALID LICENSE TO USE ALL COPYRIGHTED DOCUMENTS SPECIFIED BUT NOT INCLUDED IN THE PROJECT MANUAL.
   A. Copies of the printed AIA Documents, may be purchased from the office of the Birmingham Chapter of the American Institute of Architects, 107 South 21 Street, Birmingham, Alabama or from the American Institute of Architects, 1735 New York Avenue, NW, Washington, D.C. 20006.
   B. AIA documents are intended to be used as “consumables” and it is an infringement of the AIA copyright to reproduce blank documents. After an original document has been filled in, ten copies of the completed document may be made for that specific project.

1.02 AGREEMENT AND CONDITIONS OF THE CONTRACT
   A. See Section 00 7300 - Supplementary Conditions for the Supplementary Conditions.
   B. The Agreement form is AIA A101.
   C. The General Conditions are based on AIA A201.

1.03 FORMS
   A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in the Contract Documents.
   B. Bond Forms:
      1. Performance and Payment Bond Form: AIA A312.
   C. Post-Award Certificates and Other Forms:
      1. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).
   D. Clarification and Modification Forms:
      1. Architect’s Supplemental Instructions Form: AIA G710.
   E. Closeout Forms:
      2. Affidavit of Payment of Debts and Claims Form: AIA G706.
      4. Consent of Surety to Final Payment Form: AIA G707.

1.04 REFERENCE STANDARDS
   A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum; 2007.
   C. AIA A312 - Performance Bond and Payment Bond; 2010.
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 00 7200 - GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS
1.01 SEE AIA A201-2017 "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION"
   A. Document is available at AIA.org

RELATED REQUIREMENTS
2.01 SECTION 00 7300 - SUPPLEMENTARY CONDITIONS.

SUPPLEMENTARY CONDITIONS
3.01 REFER TO DOCUMENT 00 7300 - SUPPLEMENTARY CONDITIONS FOR AMENDMENTS TO
   THESE GENERAL CONDITIONS.

END OF SECTION
SUPPLEMENTARY CONDITIONS

The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction," AIA Document A201 2017 Edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 Add the following clause to:

All questions relative to the Contract Documents shall be addressed to the Architect for clarification. In the event of any conflict/inconsistencies in the Contract Documents for the Described Work, the following take precedence:

A. The agreement (contract)
B. Addenda
C. Supplementary Conditions
D. General Conditions
E. Drawings and specifications. In event of conflict between these two, the stricter or higher quality shall prevail.

1.1.6 Add the following clause to subparagraph 1.1.6

1.1.6.1 The reference standards referred to in the Specifications are the edition current as of the date of the receipt of bids. References to non-proprietary standards, codes and specifications, and the manufacturer’s specifications, instructions and directions mean the date included with such reference. Where no date is given, references will mean the latest edition in effect on the date of the bid receipt. Such references require that the Contractor become fully and adequately informed of the contents of such directions, specifications and codes, and will properly apply that information so that the best possible use of the item, material or technique is achieved. Before such referenced information is utilized in the Work, the Architect may request the Contractor to use editions of later date than specified. If a difference in cost is necessary, the Contract Sum will be adjusted by Change Order.

1.1 Add the following Subparagraph

1.1.9 Miscellaneous Definitions

1.1.9.1 AS SHOWN: As shown in the Drawings.

1.1.9.2 The term product used in these Supplementary Conditions includes materials, systems and equipment. Where materials, items, systems, etc. are referred to in the singular, such reference does not limit the quantity required. Furnish quantities as required to complete the Work.

1.1.9.3 Wherever the words ‘furnish’, ‘install’, ‘provide’, or equivalent words are used they mean that it will be the responsibility of the designated trade contractor to furnish and completely install the device, equipment, or material named, together with all associated devices, equipment, materials, wiring, piping, etc. as may be required for a complete and operating installation.
1.1.9.4 Architect: The firm of CMH Architects, Inc. is the Architect. Where the word ‘architect’ is used it refers to an authorized representative of the Architect.

1.1.9.5 Owner: City of Huntsville is the Owner. Where the word ‘Owner’ is used it refers to an authorized representative of the Owner.

1.1.9.6 DIRECTED, SELECTED, And APPROVED: Directed, Selected or Approved by the Architect.

1.1.9.7 EQUAL: Equal in quality and money value and similar in design or properties, in the Architect’s opinion.

1.2 CORRELATION, AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 Add the following clauses to subparagraph 1.2.1:

1.2.1.2 The precedence of the Contract Documents is as follows:

A. THE CONTRACT AND CONDITIONS (GENERAL AND SUPPLEMENTARY):
B. ADDENDA: Modifications of any nature to the Construction Documents take precedence over the original Construction Documents.
C. SPECIFICATIONS: Should there be a conflict among the specifications; the Architect will decide which stipulation will provide the best installation.
D. CONTRACT DRAWINGS: Drawings of a larger scale take precedence over those of smaller; figured dimensions take precedence over scaled dimensions; and noted materials take precedence over graphic indications.

1.2.1.3 Should the Contract Documents not agree as to the quantity or quality of the Work required, the better quantity or greater quantity must be provided unless the Architect gives other instructions in writing.

1.2.1.4 Where Contract Drawings show only a portion of the work in full detail and the remainder is shown only in outline, execute the portions in outline as required for like portions shown in full detail. Where ornament or other detail is shown by starting only, continue detail throughout the parts in which it is shown and throughout all other similar parts of the work unless otherwise explicitly required. Where items are shown in diagrammatic/schematic drawings, verify location with the Architect before installation.

1.2.4 Add the following subparagraph to paragraph 1.2:

In the case of conflicts, discrepancies or inconsistency between Drawings and Specifications or within either Document not clarified by addendum or construction bulletin, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS, AND OTHER INSTRUMENTS OF SERVICE

1.5.3 Add Subparagraph 1.5.3 to Paragraph 1.5:

The contractor shall thoroughly examine all factors reasonable available to him, including but not limited to the Drawings, Specifications, project soils report, site boundary and topography, site conditions, site history, local information, and seasonal weather conditions. Soil report data is not considered all conclusive and it is the Contractor's responsibility to further investigate site conditions as he determines necessary. The Site Contractor shall be totally responsible for acceptance of the site and preparation of the site to the proper grade and
compaction requirements as indicated by the Civil Drawings and Specifications. Any construction performed by the General Contractor on a building pad prepared by others will constitute acceptance of the pad by the General Contractor.

ARTICLE 2 - OWNER

2.1 GENERAL

2.1.1 Add the following to the end of subparagraph 2.1.1:

The term “Owner” shall also indicate all assignees and transferees of Owner.

2.2.1 Delete Subparagraph 2.2.1:

2.5 OWNER’S RIGHT TO CARRY OUT THE WORK

2.5 Delete Paragraph 2.5 in its entirety and substitute the following:

If the Contractor defaults neglects to carry out the work in accordance with the Contract Documents or fails within a three (3) day period, such default or neglect with diligence and promptness, the Owner after such three (3) day period, without prejudice to any other remedies the Owner may have, correct such deficiencies and deduct by Change Order the payments due the Contractor, the cost of correcting such deficiencies. Cost for correcting deficiencies includes actual costs incurred by the Owner as well as compensation for additional services of the Architect and their respective consultants. If payment then or thereafter due the Contractor is not sufficient to cover such amounts, the Contractor must pay the difference to the Owner.

ARTICLE 3 - CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.2.1 Add the following clause to Subparagraph 3.2.2:

The Contractor shall be responsible for the accuracy of measurements, elevations, lines and grades of work. If Contractor chooses to measure distance by scaling from the Drawings, it is totally at his risk and is not considered by Owner to be an accurate measurement. Contractor shall do field work necessary to lay out and maintain the work. Differences which may be found between Drawings and actual conditions shall be submitted to the Owner for his consideration before proceeding with the work.

3.2.5 Add the following Subparagraph to Paragraph 3.2:

The Contractor is responsible for having a thorough knowledge of all Drawings, Specifications, General Supplementary, and Special Conditions, and other Contract Documents. Failure to acquaint himself with this knowledge does not relieve him of the responsibility for performing his work in a manner acceptable to the Owner. No additional compensation will be allowed because of conditions that occur due to failure by the Contractor to familiarize himself and all works with this knowledge.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 Add the following to the end of Subparagraph 3.3.1:

Contractor agrees upon request of the Owner, to change any sequence of work provided such change does not cause delay in the completion of work or increase the cost. If such a
change does cause a delay or increase the cost, a change order maybe issued extending the time of completion and/or changes in cost.

3.3.1.1 Add the following clause to Subparagraph 3.3.1:

The Owner/Architect reserve the right to approve the Contractor’s Project Manager and/or Superintendent assigned to this project. The Owner/Architect also reserves the right to reject any of the Contractor’s personnel assigned to this project, and have the Contractor replace such personnel with acceptable, qualified personnel within 5 working days prior to beginning and during course of work.

3.4 LABOR AND MATERIALS

3.4.2 Add the following Clauses 3.4.2.1, 3.4.2.2 and 3.4.2.3 to Subparagraph 3.4.2:

3.4.2.1 After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements of the Specifications (Division 1).

3.4.2.2 By making requests for substitutions based on Clause 3.4.2.1 above, the Contractor:

(a) represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
(b) represents that he will provide the same warranty for the substitution that he would for that specified;
(c) certifies that the cost data presented is complete and includes all related costs under this Contract but excludes cost under separate contracts, and excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
(d) will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
(e) is responsible for compliance with applicable codes and ordinances.

3.4.2.3 The Architect will promptly reply in writing to the Contractor stating whether the Owner or the Architect, after due investigation, has reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection. Failure to object to a manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents, and all products furnished by the listed manufacturer must conform to such requirements.

3.4. Add the following Subparagraphs 3.4.4, 3.4.5 and 3.4.6 to Paragraph 3.4:

3.4.4 All manufactured articles, materials and equipment must be supplied, installed, connected, erected, used, cleansed and conditioned in accordance with the manufacturer’s specifications unless otherwise specified.

3.4.5 The Contractor agrees that neither he nor his subcontractors will discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to his hire, tenure, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of age, sex, race, color, religion, national origin or ancestry. Breach of this covenant may be regarded as a material breach of this Contract.

3.4.6 Comply with all applicable State and Federal statutes regarding minimum wages to be paid.
The Contract Sum will not be increased because of subsequent increases in the wage rates.

3.5 **WARRANTY**

3.5.1 **Add the following to the end of Subparagraph 3.5.1:**

All warranty periods will start at the date of substantial completion as defined in paragraph 9.8 or Owner acceptance, which ever occurs first.

3.5.1 **Modify** the as follows: Delete the word “may” in line five of paragraph 3.5.1 and substitute the word “will”

3.5 **Add the following Subparagraphs to Paragraph 3.5**

3.5.3 Workmanship and installation must be the best quality possible. Perform each part of the work and related activities with the best possible workmanship to produce work that is neat, secure, weatherproof, with the best possible appearance and utility.

3.5.4 The Architect will be the sole judge of all installed work, and may reject work that does not conform to the requirements of the Contract Documents. Repair or replace rejected work to the satisfaction of the Architect without additional cost to the Owner.

3.5.5 Contractor does hereby warranty and covenant to Owner that all materials and workmanship shall be of the highest quality, in accordance with the Contract Documents and free from defects that if any portion of Work is not of the highest quality, in accordance with the contractor Documents and free from defects, Contractor shall, upon the request of Owner, for a period of one year from the date of Grand Opening or Final Acceptance, whichever is later, of the Work under the contract, promptly correct such non-compliance or defect. For the purposes of ascertaining the quality and performance standards required by this warranty and ascertaining the Contractor’s responsibility in cases where the required performance standard has not been met. Owner and Contractor agree that they shall be guided by the performance standard for workmanship, materials, systems, and structures deemed appropriate by the Architect except for the following standards which shall be set forth:

- **.1** Should there be any conflict between the local and state Building Codes, the quality of standard for sound industry practices with regard to materials or workmanship, and the quality standard required by the Contract Documents, the higher standard shall govern.

- **.2** See additional and specific warranty information as specified in Sections 2 through 16.

3.5.6 Contractor will at all times provide proper facilities and an opportunity for the inspection of the Work by the Architect and Owner and their representatives. Contractor shall, within twenty-four (24) hours after receiving written notice from Architect proceed to takedown and remove all portions of the Work which shall have condemned as unsound, improper, or in any way failing to conform to the Contract Documents and shall replace with same with proper and satisfactory Work make good all work damaged or destroyed thereby at no cost to the Owner. Failure to discover or notify Contractor of defective or nonconforming work by Architect or Owner shall not relieve Contractor of full responsibility for replacement of the defective or nonconforming Work and all damages resulting therefrom.

3.6 **TAXES**
3.6 Delete paragraph and add the following:

The successful bidder agrees that as Contractor, he will act as limited purchasing agent for this project according to the requirements of the Agency Agreement, so the City of Huntsville, Alabama can realize the tax savings as a public entity. A copy of the Agency Agreement is included in these documents.

3.6.1 The procedure for this is as defined by Legislative Act 2013-205.

1. Comply with procedure to obtain the exemption of sales tax as outline in State of Alabama Department of Revenue Memo entitled “Tax Guidance for Contractors, Subcontractors and Alabama Governmental Entities Regarding Construction-related Contracts”.
2. The Contractor shall comply with above and submit application for exemption (form ST: EXC-01) for each tax exempt project.
3. Only materials that are going to be a permanent part of the building is tax exempt, i.e. no tools, ladders or sandpaper.

3.6.2 Add the following:

In the event this project is constructed in an area where governmental jurisdiction requires income tax to be withheld, the contractor shall comply with the requirements in a manner that will absolve the Owner of any withholding liability.

3.6 PERMIT FEES AND NOTICES

3.7.1 Add the following Clause to subparagraph 3.7.1:

All Contractors performing work must be licensed as required by the state, county, and/or municipality having jurisdiction. Transmit copies of license certificate to the Architect and Owner within ten (10) days following the execution of the contract.

3.7.2 Delete subparagraph 3.7.2 in its entirety and replace with the following:

The Contractor shall be totally and solely responsible for compliance with and notices under all licensing laws and other statutory requirements which apply to himself or any Subcontractor actively engaged in any work on the project.

3.7.3 Add the following to the end of the paragraph 3.7.3:

The Contractor’s work includes, without limitation, all disposal or removal of waste and rubbish attributed to the project and warrants that it is familiar with all applicable federal, state and local laws and ordinances concerning disposal of waste and rubbish.

3.13 USE OF SITE

3.13 Add the following to the end of Paragraph 3.13:

The Contractor shall comply with all instructions of the Owner given to it with regards to the use of site.

3.18 INDEMNIFICATION

3.18.1 Delete and replace with the following:

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

ARTICLE 5 – SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 Add the following clause to subparagraph 5.1.1:

5.1.1.1 Any Subcontractor performing work must be licensed as required by the State, County, and/or municipality having jurisdiction. Transmit copies of license certificates to the Architect and Owner within ten (10) days following the execution of the Contract.

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

5.2.1 Add the following to end of subparagraph 5.2.1:

Within twenty-four (24) hours after bids are opened, a detailed Contractor’s Subcontractor’s list will be furnished to the Owner by the Contractor and also made part of the Close-Out book. The following will be required:

1. All Subcontractors’ and major suppliers’ company name, address, phone number and scope of work.
   a. Only one subcontractor can be listed for each description or trade and all subcontractors must be listed.
   b. These listed subcontractors cannot be changed without written approval of the Owner and Architect.

Article 5 Add the following Paragraph to Article 5:

5.5 SUBCONTRACTOR DUTIES

5.5.1 All subcontractors will participate in installing and removing general temporary protection measures and completing a nightly cleaning at the end of each workshift. Participation will be proportional to the level of manpower present on site for given night’s work.

5.5.2 All subcontractors will be provided with a temporary utility source, toilet facilities, and dumpster (for common trash). All other general conditions, temporary facilities, staging components, scaffolding, hoisting, conveyance equipment, etc. required for the commission of its scope of work shall be furnished, installed, and subsequently removed by subcontractor.

5.5.3 All subcontractors will perform a daily cleanup of its debris. All common trash may be placed in the General Contractor furnished project dumpster. All bulk debris resulting from
subcontractor’s scope of work will be properly disposed off site by subcontractor.

5.5.4 All subcontractors shall furnish, install, and subsequently remove adequate protection measures for new and existing finishes, equipment, and furnishing to protect against damage that may result from the commission of subcontractor’s scope of work.

ARTICLE 7 - CHANGES IN THE WORK

7.1 CHANGES

7.1.1 Add the following to the end of the subparagraph 7.1.1:

No Change Orders, Construction Change Directives or order for a minor change in the work will be considered unless approved by the Owner in writing prior to the work performed.

7.1.1 Add the following clause to subparagraph 7.1.1:

7.1.1.1 It is agreed the Owner has the right to request changes during performance of the Contract for Construction. The Contractor agrees to perform those requested changes for a fair and reasonable cost/credit and within the time directed by the Owner, whether the change requires an increase or a decrease to the Scope of the Work.

a. A fair and reasonable cost is defined as not greater than the current industry standard for the type work and circumstances under which it is to be performed. Means Construction Cost Data, latest edition, with locality factors taken under consideration, will be used as a guide and costs may not be higher without sufficient documentation to, in the Architect’s, substantiate the increase. The Architect may also check costs against current similar work on other projects.

b. A fair and reasonable time extension is defined as the net increase to the overall project schedule, as sufficiently documented by the Contractor and clearly determined justifiable by the Architect’s review of the current Project Schedule. A request for a time extension must accompany any and all of the Contractor’s cost proposal submittals or no additional time will be allowed.

7.1 Add the following subparagraph to paragraph 7.1:

7.1.4 If the net value of a change or deletion results in a Credit to the Owner, the Credit shall be the net without profit and overhead.

7.2 CHANGE ORDERS

7.2.1.2 Delete clause 7.2.1.2 in its entirety and replace with the following:

the amount of the adjustment or non-adjustment in the Contract Sum, if any.

7.2.1.3 Delete clause 7.2.1.3 in its entirety and replace with the following:

the extent of the adjustment or non-adjustment in the Contract Time, if any.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.4 Clarification of Subparagraph 7.3.4:

The phrase “…an amount for overhead and profit…” is interpreted to mean not more than a
total of 25% for Contractor, Subcontractor and Sub-subcontractors (where applicable). Where the Contractor is performing the work with his own forces, the maximum allowable markup for overhead and profit is 15%. Where a subcontractor is performing the work, the maximum allowable markup for overhead and profit is 15% for the subcontractor and his sub-subcontractors and 10% for the Contractor.

Cost of the work is limited to cost of materials, delivery, labor, Social Security, Unemployment Insurance, Workmen’s Compensation Insurance, rental of power tools/equipment, bond premiums and permits.

Overhead is defined as, supervision, superintendence, time keepers, watchmen, clerks, small tools, incidentals, general office expense and other expenses not included in the “cost” above.

ARTICLE 8 – TIME

8.1 DEFINITIONS

8.1.2 Add the following clause to subparagraph 8.1.2

8.1.2.1 Notice to Proceed will be issued. Obtain necessary insurance and permits, file documents and notices and commence the Work as soon as notified. Ten (10) days will be allowed for mobilization.

8.3 DELAYS AND EXTENSION OF TIME

8.3.1 Add the following to the end of subparagraph 8.3.1:

In the event that in the opinion of the Owner, in order to meet the construction schedule and to complete the Work within the time specified by this Agreement, the Contractor needs to employ additional personnel and labor and to have such employees work on an overtime basis, including but not limited to Saturdays, Sundays and holidays, in order to meet such Contractor’s schedule and the completion dates as required by this Agreement, then the Contractor agrees to immediately comply with such instructions as are given with regard thereto at no additional cost to the Owner. However, nothing in this paragraph supersedes Paragraph 8.3.1 of General Conditions. If the Contractor is delayed by causes beyond its control, the Owner may by written authorization to the Contractor accelerate the time of completion. As a result, the Contractor at the Owner’s expense will employ additional personnel and labor and have such employees work on an overtime basis. The cost of this overtime work will be reported to the Owner weekly and may be terminated by the Owner at any time.

8.3 Add the following subparagraph to paragraph 8.3:

8.3.4 Should a Contractor fail to complete his work within the time allowed by the Project Schedule at no one’s fault but his own, he will be responsible for paying the Owner all costs incurred for the Owner’s consultants and subconsultants hired in conjunction with the execution of the work. The period that the Contractor will be responsible for such costs is from the point that the Contractor’s work exceeded the scheduled completion date until the date of actual substantial completion.

Article 8 Add entire Paragraph 8.4 including Subparagraphs and Clauses to Article 8

8.4 REIMBURSEMENT OF CONSULTANTS
8.4.1 The involved Contractor is responsible for paying the Owner all costs incurred for consultants, including sub-consultants hired in the performance of the Work, including their overhead and profit, relative to the project during the following period:

8.4.1.1 After the Contract Time, as defined in this Article, has expired, until the actual date of Substantial Completion or Completion.

ARTICLE 9 - PAYMENTS AND COMPLETION
9.2 SCHEDULE OF VALUES

9.2 Add the following subparagraph to paragraph 9.2:

9.2.1 All pay request forms are to be on form acceptable to the City of Huntsville, Application and Certification for Payment must be supported by the AIA document G703 continuation sheet or another form acceptable to the Owner and Architect. Submit three (3) notarized original applications monthly or as required by Owner.

9.3 APPLICATION FOR PAYMENT

9.3.1 Delete the Subparagraph 9.3.1 in its entirety and replace with the following.

All payments must be submitted to the Owner for review and processing on form approved Owner, provided minimum three original copies or as required by Owner. Such application shall be notarized, and supported by such data substantiating the Contractor’s right to payment, such as copies of requisitions from subcontractors and material suppliers. The Owner shall determine the amount less retainage of each Application for Payment that is properly due and will issue payment for such amount, if Owners Lender does not reasonably object to such payment, no later than twenty (20) days after the first day of the next month following the period covered by the Application for Payment, provided the properly completed Application for Payment is in Owner’s possession not later than the 1st day of the month.

9.3.1.1 Add following to end of Clause 9.3.1.1:

Application for Payment shall be submitted on form(s) acceptable to the City of Huntsville. All listings of items to agree with the Schedule of Values (Paragraph 9.2).

9.3.1 Add the following clauses to subparagraph 9.3.1:

9.3.1.3 The Contractor is provided with a Monthly Receipt and Release of Lien form by Owner as part of the Contract Documents Package and the Contractor shall properly complete and submit the required form with each Application for Payment. No payment will be issued without the fully executed Lien Waiver. This must be accompanied by fully executed Lien Waivers from all appropriate Subcontractors and Suppliers involved in the preceding Application for Payment.

9.3.3 Add the following Clauses to Subparagraph 9.3.3:

9.3.3.1 In the event Owner receives information that indicates a lien has been filed or that there exists a potential lien situation, the Contractor will be notified by the Owner and they will expect the Contractor to immediately resolve the situation to the satisfaction of the Owner. All monies requested for this pay period, as described in Part 9.3.1, shall be withheld until such liens have been removed and the dispute rectified.

9.3.3.2 It is hereby agreed between the Owner and the Contractor that each properly executed
Monthly Receipt and Release of Lien form is a valid lien release form, the Contractor thereby agrees to defend and indemnify the Owner against any and all claims resulting from a lien against the property.

9.3.3.3 Payment for materials stored off site will not be made by Owner unless approved by the Architect. Also, Contractor submitting request for payment of stored materials must attach proof of adequate insurance coverage of such materials to the pay request for the month they are making the request.

9.6 PROGRESS PAYMENTS

9.6.2 Add the following clause to subparagraph 9.6.2:

9.6.2.1 All monies paid on account to Contractor for materials or labor used in the performance of the Work will be regarded as funds held in trust solely for payment of any and all of contractor's obligations relating to or arising out of the Work including the payment of all subcontractors and suppliers of the contractor who have supplied labor, equipment, or materials or performed any work whatsoever on this Project.

9.6 Add the following Subparagraphs and clauses to Paragraph 9.6:

9.6.9 Procedures for processing payments for stored materials and release of retainage:

9.6.9.1 The maximum amount of retainage that may be withheld from partial payments is five percent (5%) of the value of the estimated work performed and the value of materials stored on-site or stored off-site in compliance with paragraph 9.3.3.3. With regards to materials stored off-site, the Construction Manager must receive proof of adequate insurance of such materials; must approve the storage facility in which they are placed; and must verify both the quantity and quality of such materials, all before the Contractor’s application for partial payment will be processed.

9.6.9.2 After the Contractor has been paid fifty percent (50%) of the then current amount of his Contract, no further retainage will be withheld from partial payments as they become due to him.

9.6.9.3 Upon completion of the construction Project and completion of the punch list, the Owner will pay 100% of the amount due the Contractor less retainage. Upon completion of all close-out requirements, including submission of all applicable releases, record documents and warranties, the Owner will pay all retainage.

9.8.6 Substantial Completion (completion of punch lists) must be achieved within the time limits established in the Project Schedule for each phase to relieve the Contractor of responsibility for liquidated damages.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Add the following clause to subparagraph 9.8.1:

9.8.1.1 The date of commencement of Work and the date of Substantial Completion shall be agreed upon between the Owner and the Contractor at the time of Contract award and shall be made part of the Construction Agreement between the Owner and Contractor.
9.8.6 **Add the Subparagraph to 9.8:**

Substantial Completion (completion of punch lists) must be achieved within the time limits established in the Project Schedule for each phase to relieve the Contractor of responsibility for liquidated damages.

9.9 **PARTIAL OCCUPANCY OR USE**

9.9.1.1 **Add the following Clauses to Subparagraph 9.9.1:**

If the Owner elects to occupy or use any completed or Partially completed portion of the Work as permitted by Paragraph 9.9, the Contractor agrees to cooperate in the segregation and coordination of its construction activities. Such occupancy does not relieve the Contractor of liability to perform work required by the contract that has not been completed at the time of occupancy.

9.9.1.2 Prior to the foregoing occupancy activity beginning, it is essential that the following steps be taken by the Contractor:

1. Fire Escapes: Fire exits shall have the illuminate exit signs installed above the exit openings. Panic hardware shall be installed and fully operational. Required exits must be kept usable throughout the construction period. Provide lighted, enclosed walkways through construction areas and make other provisions for safety as required by governmental authorities having jurisdiction.

2. Building Security: Required door locks at doors are installed and operational.

3. Fire Protection Sprinkler System: The fire protection sprinkler system shall be completely operational.

9.10 **FINAL COMPLETION AND FINAL PAYMENT**

9.10 **Add the following to the paragraph 9.10:**

9.10.6 The Final Application for Payment under paragraph 9.3.1 will not be approved for payment by the Owner until the following items are provided to the Owner by the Contractor in a "Close-Out Book" consisting of a black, three-ring binder with tabs for each category and any other Close-Out Document required by the specifications:

- .1 Final List of Subcontractors and Material Suppliers with their address, phone number and scope of work.

- .2 General Contractors Statement of one year Warranty.

- .3 Final Unconditional Lien Releases from General Contractor and All Subcontractors and Suppliers.

- .4 Final Inspection Approvals (See Specifications)

- .5 Red-Lined As-Built Drawings

- .6 Electronic As-Built files in latest version of AutoCAD, 1 set of mylars and 2 sets of prints in 30” x 42’ format.

- .7 Any and all operational manuals including but not limited to HVAC, plumbing and
electrical.

.8 All Building Permits

.9 Consent of Surety

.10 Signed receipts by Owner of attic stock.

.11 All warranties required by Contract documents for Contractor’s work.

.12 Video copies on DVD (2ea) of all Training required by the contract for Owner’s future use.

.13 certified copy of Architect’s Certificate of Substantial Completion.

Immediately after completion of the Contract, the Contractor is to publish an Advertisement of Completion (see sample form) in a newspaper of general circulation in Jefferson County once a week for four consecutive weeks. Submit proof of publication of said notice by affidavit of the publisher, and a printed copy of the notice, to the Owner, in care of the Architect. In no instance will a final settlement be made upon the contract until the expiration of thirty (30) days from the completion of the contract.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1 Add the following Subparagraphs to Paragraph 10.1:

10.1.1 All work performed in conjunction with this project will be done in full compliance with all current United States Occupational Safety and Health Administration (OSHA) regulations.

10.1.2 Provide temporary bracing and shoring and protect work. Comply with State and local codes, and all U.S. Occupational Safety and Health Administration (OSHA) regulations. Contractor is responsible for the performance of his temporary work. Protect work in progress and upon removal of temporary work, protect all surrounding existing work.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 Add the following Clause to Subparagraph 10.2.1:

10.2.1.4 Material and equipment provided by the Owner shall be received, stored, secured and protected in accordance with Paragraph 10.2.1.2 of the General Conditions. Incurred costs for receiving, storage, liability, and warranty labor shall be included in the Contract Amount. The Owner shall not be responsible for any contractor’s material and equipment until Owners final acceptance as described in Paragraph 9.10.

10.2.8 Delete Subparagraph in its entirety and insert the following:

All accidents arising out of or in connection with the work which cause death, personal injury, or property damage are to be reported in writing immediately to the Owner, Construction Manager and Architect. These reports are to provide full detail of the incident, including any witness statements. All accident reports are to be submitted within one (1) calendar day. In addition, if death, serious personal injury or serious property damage should occur, report the accident immediately by telephone or messenger to the Owner, Construction Manager or
ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR’S LIABILITY INSURANCE

11.1.1 Add the following to the end of Subparagraph 11.1.1:

The Contractor agrees to obtain, furnish and maintain in full force and effect without interruption during and throughout the entire term of the Agreement and for five (5) years thereafter, at its sole cost, all of the insurance required by and described in this Exhibit. All of said insurance shall be written by, and secured from, a responsible company or companies which are satisfactory to Owner and which are authorized to engage in such insurance business in the state where the work is being performed. Each policy of insurance shall be issued by insurers with a current AM Best’s rating of A- IX or better. All of said insurance shall be written for not less than the limits specified herein, or as required by law, whichever is greater.

11.1.2 Delete Subparagraph 11.1.2 in its entirety and substitute the following:

The insurance required by Subparagraph 11.1.1 must be written for not less than the following limits of liability, or greater if required by law. Additionally named insured must be City of Huntsville, City of Huntsville Mayor (named individually), City of Huntsville Mayor Pro Tem (named individually), Huntsville City Council, Each Council Member individually, CMH Architects, LBYD Engineering, BBGS Engineering Consultants, Hyde Engineering.

.1 Worker’s Compensation:
   (a) State: Statutory.
   (b) Applicable Federal: Statutory.
   (c) Employer’s Liability Insurance limits shall be at least:
      i. Bodily Injury by Accident - $1,000,000 each accident
      ii. Bodily Injury by Disease - $1,000,000 each employee

.2 Comprehensive or Commercial General Liability including Premises-Operations; Independent Contractors’ Protective; Products and Completed Operations; Broad Form Property Damage:
   (a) General Aggregate: $2,000,000 per Project
   (b) Products, Completed Operations Aggregate: $2,000,000 per Project
   (c) Personal and Advertising Injury: $1,000,000 per Occurrence
   (d) Each Occurrence: $1,000,000
   (e) Additional Requirements for Commercial Liability Insurance:
      i. Products and Completed Operations shall be maintained for 2 years after final payment.
      ii. Property Damage Liability: Include X, C and U coverage.
      iii. Broad Form Property Damage shall include Completed Operations.
      iv. The policy shall name the Owner, Architect, and their agents, consultants and employees as additional insured, state that this coverage shall be primary insurance for the additional insured; and contain no exclusions of the additional insured relative to job accidents.
      v. The policy must include separate per project aggregate limits.
.3 Business Automobile Liability including owned, non owned and hired vehicles:
   (a) Combined Single Limits: $1,000,000 each occurrence
   (b) Additional Requirements of Business Automobile Liability:
      i. The policy shall name the Owner, Architect, and their agents, consultants and employees as additional insured.

.4 Umbrella Excess Liabilities:
   (a) Umbrella Excess Liability Insurance to provide excess coverage above the Commercial General Liability, Business Automobile Liability and the Workers' Compensation and Employer's Liability to satisfy the minimum limits set forth herein.
   (b) Minimum Combined Primary Commercial General Liability and Umbrella Excess Liability limits of:
      i. $5,000,000 per Occurrence
      ii. $5,000,000 Aggregate
   (c) Additional Requirements for Umbrella Excess Liability Insurance:
      i. The policy shall name the Owner, Architect, and their agents, consultants and employees as additional insured.
      ii. The policy must be on an “occurrence” basis.

.5 Builder’s Risk Insurance:
   (a) The Builder’s Risk Policy shall be made payable to the Owner and Contractor, as their interests may appear. The policy amount shall be equal to 100 percent of the Contract Sum, written on a Causes of Loss-Special Form (current addition as of the date of Advertisement for Bids), or its equivalent. All deductibles shall be the sole responsibility of the Contractor.
   (b) The policy shall be endorsed as follows:
       “The following may occur without diminishing, changing, altering or otherwise affecting the coverage and protection afforded the insured under this policy:
       i. Furniture and equipment may be delivered to the insured premises and installed in place ready for use; or
       ii. Partial or complete occupancy by Owner; or
       iii. Performance of work in connection with construction operations insured by the Owner, by agents or lessees or other contractors of the Owner, or by contractors of the lessee of the Owner.”

11.1.2.1 Add the following Clauses to Subparagraph 11.1.2:

1. Insurance shall be maintained with a reliable company (having at least “IV” or better financial rating and “A-” or better general policyholder’s rating according to the latest A.M. Best report of Contractor’s choice, acceptable to, approved by Owner, authorized to do business in the state where project is located. Contractor shall require his subcontractors to provide insurance certificates for Workers’ Compensation and General Liability insurance.

2. The Contractor shall be responsible for securing Certificates of Insurance from all Subcontractors.

11.1.3 Add to Subparagraph 11.1.3 the following:

A Certificate of Insurance, acceptance to the Owner, MUST BE RECEIVED by the Owner before the Owner will execute the Contract or before any work is performed on the project, whichever is the earliest date. The certification must indicate that the limits listed are provided and that insurance will not be canceled while the work specified is in progress without thirty (30) days prior written notice to Owner. Failure to provide the proper Certificate of Insurance as required above may result in the cancellation of the award of Contract.
11.1.5 Add the following Subparagraph 11.1.5:

Insurance coverage limits required under this article shall be written for not less than the limits required by law or the following amounts, whichever is greater:

The contractor shall include within his umbrella insurance policy or shall purchase and maintain in a company or companies licensed to do business in the state in which the project is located, such insurance as indicated herein. Such insurance shall protect the Owner, Owner's Consultants, Architect, Architect's Consultants and the Contractor from claims which may arise out of or result from operations be by himself or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

Owner, Architect, their employees, consultants or agents shall be named insured for Commercial General Liability and excess Liability Insurance for this project.

OWNER MUST BE NAMED AS AN ADDITIONAL, NAMED INSURED ON ALL POLICIES OF INSURANCE

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.2 SUCCESSORS AND ASSIGNS

13.2.1 Add the following:

Owner shall have the right to assign the Contract without the Contractor's consent, provided, however, if Owner does so assign the Contract without Contractor's consent, Owner will not be relieved of its obligations under the Contract.

The Contractor will consent to an assignment of this contract to the Lender, as security.

13.4 TESTS AND INSPECTIONS

13.4.1 Delete and replace with the following:

Construction testing shall be performed by an independent testing laboratory selected and paid for by the Owner. Preparation of pavement mix designs is the responsibility of the Contractor and is not part of the testing services to be paid for by the Owner. The Contractor shall coordinate scheduling for construction testing and shall also provide reasonable assistance needed by the testing laboratory to insure that the proper testing procedures are followed. Failure to notify the testing laboratory prior to installation will result in the Contractor repairing or replacing such work until proper testing procedures are met. The independent testing laboratory shall prepare certified test reports that indicate the type, location, date time, conditions, and results of each test. The Owner, Contractor and Tenant (if applicable) shall be provided with copies of each test report within 48 hours of the time the test was performed. In the event a test fails to comply with Drawings and Specifications, Owner and Contractor shall be notified immediately by the testing laboratory.

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 Add the following Clauses to Subparagraph 14.2.1:
14.2.1.5 Fails to provide proper supervision or displays an inability to complete the work as scheduled.

14.2.1.6 Refuses to correct defective work after notification:

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4 Delete Section 14.4 (including Paragraphs 14.4.1, 14.4.2, and 14.4.3) and replace it with the following:

14.4.1 The Owner reserves the right to terminate the Contract for convenience and without cause even though the Contractor has not failed to perform any part of the Contract. Termination of the Work hereunder shall be affected by written notice to the Contractor. Upon receipt of such notice, the Contractor shall, unless the notice otherwise directs,

.1 Immediately discontinue the work and the placing of all orders and subcontracts in connection with this Contract.

.2 Immediately cancel all of the existing orders and subcontracts made hereunder; or at Owner’s option, assign to Owner all or part of such existing orders and subcontracts;

.3 Immediately transfer to the Owner all materials, supplies, Work in progress, appliances, facilities, machinery, and tools acquired by the Contractor in connection with the performance of the Contract, and take such action as may be necessary or as the Owner may direct for protection and preservation of the Work relating to this Contract; and

.4 Deliver all plans, drawings, specifications, and other necessary information to the Owner.

14.4.2 If the Owner terminates the Contract for convenience, the following shall be the Contractor’s exclusive remedies:

.1 Reimbursement of all actual expenditures and costs approved by the Owner as having been made or incurred in performing the Work;

.2 Reimbursement of expenditures made and costs incurred with the Owner’s prior written approval in settlement or discharging outstanding commitments entered into by the Contractor in performing the Contract, and

.3 Payment of profit, insofar as profit is realized hereunder, of an amount equal to the estimated profit on the entire Contract at the time of termination multiplied by the percentage of completion of the Work. In no event shall the Contractor be entitled to anticipated fees or profits on work not required to be performed.

14.4.3 All obligations of the Contractor under the Contract with respect to completed Work, including but not limited to all warranties, guarantees, and indemnities, shall apply to all Work completed or substantially completed by the Contractor prior to a convenience termination by the Owner. Notwithstanding the above, any convenience termination by the Owner or payments to the Contractor shall be without prejudice to any claims or legal remedies that the Owner may have against the Contractor for any cause.

14.4.4 Upon a determination that a termination of this Contract other than a termination for convenience under this Article was wrongful or improper for any reason, such termination shall automatically be deemed converted to a convenience termination under this Article, and the Contractor’s remedy for such wrongful termination shall be limited to the recoveries specified under Subparagraph 14.4.2 of this Article.
Article 16  Add Article 16 as follows:

ARTICLE 16 – ADDITIONAL PROVISIONS

16.1 HARMONY CLAUSE

16.1  Add the following Paragraph:

The Contractor and all Subcontractors agree that no labor dispute of any kind involving any Contractor or Subcontractor, or their employees or agents shall be permitted to occur or be manifested on the Project and the Contractor and Subcontractors to that end to only employ persons on the Work who will work at all times in harmony with other persons employed of the Project.

The Contractor and all Subcontractors agree and their employees shall not participate in or accede to any work stoppage, slow down or any type of interference with the performance of work by other persons on the project which may occur as a result of any labor dispute involving their employees.

Should there be a work stoppage, slow down or any type of interference with the performance of work by other persons on the project involving the Contractor or his employees or a Subcontractor or his employees resulting from a labor dispute and which in the judgment of the Owner will cause, or threatens to cause delay in the progress of construction, then upon twenty-four (24) hours written notice, Owner shall have the right to declare the Contractor and/or Subcontractor in default under this Contract and take such steps as are necessary to finish the uncompleted portion of work. In such event Owner shall have the right to take possession of and use all of the Contractor’s and/or Subcontractor’s materials (exclusive of tools) intended for use on the Work. The cost of completion including all expenses, attorney’s fees and costs incurred in resolving the labor dispute shall be charged against the Contractor and/or Subcontractor’s remaining interest in the Contract amount.

Should the Contractor and/or Subcontractor(s) become involved in a labor dispute resulting in a work stoppage, slow down or any type of interference with the progress of construction and resulting in an increase in interest charges to Owner, the Contractor and/or Subcontractor(s) shall be liable to Owner for this increased cost. If the Contractor and/or Subcontractor’s agree to pay Owner such excess within thirty (30) days after written demand for such excess has been made upon him by Owner.

Should the Contractor and/or Subcontractor(s) become involved in a contractual dispute resulting in a lien being placed on the project work stoppage, slow down, or any type of interference with the progress of construction and in the judgment of the Owner will cause, or threatens to cause delay in the progress of construction, then upon twenty-four (24) hours written notice, Owner shall have the right to take possession of and use all of the Contractor and/or Subcontractor’s material (exclusive of tools) intended for use on the project. The cost of completion, including all expenses, attorney’s fees and costs incurred in resolving subject disputes shall be charged against the Contractor and/or Subcontractor’s remaining interest in the Contract amount.

Harmony clause provisions similar to the provisions of the immediately preceding paragraphs shall be included in any of the Contractor and/or Subcontractor’s subcontracts relating to the Work.

16.2 ALABAMA IMMIGRATION LAW - E-VERIFY AFFIDAVIT

16.2  Add the following paragraph (including subparagraphs) 16.2:
16.2.1 The Contractor is required to comply with the Beason-Hammon Alabama Taxpayer and Citizen Protection Act, 31 – 13-1 et seq. of Code of Alabama 1975 (Act No. 2011-535), subsequently all bidders are required to submit a copy of their enrollment confirmation into the E-Verify program. A copy of the confirmation form shall be attached to their Sealed Bid Proposals, no affidavit is required.

16.2.2 All successful contractors will be required to furnish to the Owner and Architect, a copy of the E-Verify confirmation for all their subcontractors and material vendors before they will be allowed to work on or furnish materials to the project.

Article 17 Add Article 17 as follows:

ARTICLE 16 - APPLICABLE PUBLICATIONS (SUPPLEMENTARY)

17.1 REFERENCE

17.1.1 Any reference to a publication by its basic designation shall be a reference to the issue, edition and amendment (if any) of that publication current on the date of these specifications. That publication shall for a part of these specifications to the extent indicated by the reference thereof.

17.2 ABBREVIATIONS

17.2.1 Abbreviation used refers to the following basic publications: ACI, American Concrete Inst.; AIA, American Inst. of Architects; AISC, American Inst. of Steel Const.; ASHRAE, American Society of Heating, Refrigeration and Air Conditioning Engineers; ASTM, American Society for Testing and Materials; CRSI, Concrete Reinforcing Steel Inst.; Fed. Spec. (FD), Federal Specifications; SJI, Steel Joist Inst.; CS, U.S. Dept. Of Commerce Commercial Standards; and ANSI, American National Standards Inst.

Article 18 Add Article 18 as follows:

ARTICLE 17 - GUARANTEE (SUPPLEMENTARY)

18.1 The General Contractor shall guarantee the Work performed under the Contract Documents from any defects due to materials or workmanship, and for necessary adjustments to mechanical systems for a period of one year from date of Owner’s Final Acceptance of the Work. The General Contractor shall cut out and replace any defective work, materials or equipment, at his own expense, that occur during the year following acceptance of the work.

END OF SUPPLEMENTARY CONDITIONS.
SECTION 01 1000 - SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Merchant's Square - Parking Deck
B. Owner’s Name: City of Huntsville.
C. Architect’s Name: CMH Architects, Inc.
D. The Project consists of the construction of a Precast Concrete Parking Structure of 1 elevated level with a total capacity of approximately 90 cars located in Huntsville, AL. Work consists of precast structure, elevator, mechanical, plumbing, electrical and fire protection.

1.02 CONTRACT DESCRIPTION

1.03 DESCRIPTION OF ALTERATIONS WORK

1.04 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
B. Arrange use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner.
   3. Use of site and premises by the public.
C. Provide access to and from site as required by law and by Owner:
   1. Do not obstruct roadways, sidewalks, or other public ways without permit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.
B. Documentation of changes in Contract Sum and Contract Time.
C. Change procedures.
D. Correlation of Contractor submittals based on changes.
E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Payment Request Form provided by City of Huntsville.
B. Document 00 7300 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.

1.03 SCHEDULE OF VALUES

A. Forms filled out by hand will not be accepted.
B. Submit draft of AIA Document G703 Continuation Sheet.
C. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization.
F. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
G. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
H. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
I. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
J. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.
B. Form to be used: Attachment "G" Request for Payment Form provided by the City of Huntsville.
C. Submit forms as directed in the Supplement to General Requirements paragraph 12 (provided by City of Huntsville).
D. Forms filled out by hand will not be accepted.
E. Notarize and execute certification by signature of authorized officer.
F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
G. List approved Change Orders on Payment Request where indicated. Change Orders on Payment form shall be included in the Schedule of Values submitted with Request for Payment.
H. Submit three signed and notarized copies of each Application for Payment.
I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Schedule of unit prices.
   5. Submittals Schedule (preliminary if not final).
   6. List of Contractor's staff assignments.
   7. List of Contractor's principal consultants.
   10. Initial progress report.
   12. Certificates of insurance and insurance policies.

J. Include the following with each application:
   1. Construction progress schedule, revised and current as specified in Section 01 3000.
   2. Partial release of liens from major Subcontractors and vendors.

K. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.

B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, CMH Architects, Inc. will issue instructions directly to Contractor.

C. For other required changes, CMH Architects, Inc. will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

D. For changes for which advance pricing is desired, CMH Architects, Inc. will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 working days.

E. Contractor may propose a change by submitting a request for change to CMH Architects, Inc. describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000. Changes submitted by the Contractor must include any design fees for changes to the contract documents required to implement the proposed changes.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by CMH Architects, Inc. for work falling under a fixed price contract, the amount will be based on Contractor's price quotation as approved by CMH Architect's and the City of Huntsville.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by CMH Architects, Inc. and the City of Huntsville.
3. For change ordered by CMH Architects, Inc. or the City of Huntsville, without a quotation from Contractor, the amount will be determined by CMH Architects, Inc. based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.
1. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: CMH Architects, Inc. will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

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

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

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

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

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 2300 - ALTERNATES

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Description of Alternates.
   B. Procedures for pricing Alternates.
   C. Documentation of changes to Contract Price and Contract Time.

1.02 RELATED REQUIREMENTS

1.03 ACCEPTANCE OF ALTERNATES
   A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner’s option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
   B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES
   A. Alternate No. 1 - Add reveal in precast panel as described on Architectural Elevations and precast drawings. Refer to A3.4:
   B. Alternate No. 2 - Add Vertical Panels at North Elevation as described on the Architectural Elevations and Structural Drawings. Refer to A3.4:
   C. Alternate No. 3 - Add Wall Sconces to North Elevations as described on Architectural Elevations and Electrical Drawings. Refer to A3.4:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Preconstruction meeting.
   B. Progress meetings.
   C. Construction progress schedule.
   D. Progress photographs.
   E. Coordination drawings.
   F. Submittals for review, information, and project closeout.
   G. Number of copies of submittals.
   H. Submittal procedures.

1.02 RELATED REQUIREMENTS
   A. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION
3.01 PRECONSTRUCTION MEETING
   A. Schedule meeting after Notice of Award.
   B. Attendance Required:
      1. Owner.
      2. CMH Architects, Inc.
      3. Contractor.
   C. Agenda:
      1. Execution of Owner-Contractor Agreement.
      2. Submission of executed bonds and insurance certificates.
      4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
      5. Designation of personnel representing the parties to Contract, General Contractor and CMH Architects, Inc.
      6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
      7. Scheduling.
      8. Scheduling activities of a Geotechnical Engineer.
   D. Record minutes and distribute copies within two days after meeting to participants, with two copies to CMH Architects, Inc., Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS
   A. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
   B. Attendance Required:
      1. Contractor.
      2. Owner.
      3. CMH Architects, Inc.
      4. Contractor's Superintendent.
      5. Major Subcontractors.
   C. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to Work.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to CMH Architects, Inc., Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE
A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.
C. Within 10 days after joint review, submit complete schedule.
D. Submit updated schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS
A. Submit new photographs at least once a month, within 3 days after exposure.
B. Photography Type: Digital; electronic files.
C. Provide photographs of construction throughout progress of Work produced by an experienced photographer, acceptable to CMH Architects, Inc.
D. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Final completion, minimum of ten (10) photos.
E. Views:
   1. Consult with CMH Architects, Inc. for instructions on views required.
   2. Provide factual presentation.
   3. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.05 SUBMITTALS FOR REVIEW
A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
B. Submit to CMH Architects, Inc. for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

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

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

3.06 SUBMITTALS FOR INFORMATION

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

B. Submit for CMH Architects, Inc. 's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submittals may be provided in PDF format via email to the designated party(s) for review. PDF documents shall be at native size and oriented right-side up, documents that are illegible or submitted out of scale or not in the correct orientation will be rejected. File submitted electronically will be electronically marked-up and a file with comments will be returned to the Contractor.

B. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches (215 x 280 mm): Submit the number of copies that Contractor requires, plus two copies that will be retained by CMH Architects, Inc.

C. Documents for Information: Submit two copies.

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

3.09 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
   2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
B. Transmit each submittal with a copy of approved submittal form.
C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
F. Schedule submittals to expedite the Project, and coordinate submission of related items.
G. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
I. Provide space for Contractor and CMH Architects, Inc. review stamps.
J. When revised for resubmission, identify all changes made since previous submission.
K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
L. Submittals not requested will not be recognized or processed.

END OF SECTION
SECTION 01 3100 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section covers procedures for Architect's administrative requirements concerning Contract Modifications.
   B. Refer to Supplemental General Requirements for procedures and administrative requirements of the owner with regard to Contract Modifications.
   C. Related Sections include the following:
      1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.03 MINOR CHANGES IN THE WORK
   A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's standard form titled "Architect's Supplemental Instructions" (copy attached at end of this section).

1.04 PROPOSAL REQUESTS
   A. Owner-Initiated Proposal Requests: Contact Owner for instructions and procedures. Copy of Architect's form is attached at the end of the section.
   B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect. Contact Owner for additional requirements or procedures.
      1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
      2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities
      3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      4. Include costs of labor and supervision directly attributable to the change.
      5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
   C. Proposal Request Form: Use form acceptable to the Architect and Owner.

1.05 CHANGE ORDER PROCEDURES
   A. Contact Owner for Change Order instructions and procedures.

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

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.07 REQUEST FOR INFORMATION

A. Request for Information (RFI): Contractor shall issue written requests for information on a standard form acceptable to the Architect. All requests shall include the following information:
   1. A description including enough information to determine what clarification or additional information is being requested.
   2. Sequentially number each request.
   3. Date each request.
   4. All requests shall include the name of the project, and the Architect’s project number.
   5. Provide a space for a response by the Architect and/or his consultant.

B. Upon receipt of an RFI in the approved format. Architect will respond in writing. No RFI will be reviewed which is not in the approved format.
   1. Written responses by the Architect or consultant to an RFI do not constitute authorization to proceed with work, which would result in a change in contract sum or contract time.
   2. Contractor shall comply with procedures outlined by the modification procedures included in this section and any authorization to proceed with work affecting contract time or contract sum must be approved in writing as outlined in this section before proceeding with work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 3216 - CONSTRUCTION PROGRESS SCHEDULE

PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Preliminary schedule.
   B. Construction progress schedule, bar chart type.

1.02  SUBMITTALS
   A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
   B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   C. Within 10 days after joint review, submit complete schedule.
   D. Submit updated schedule with each Application for Payment.

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

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION
3.01  PRELIMINARY SCHEDULE
   A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02  CONTENT
   A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
   B. Identify each item by specification section number.
   C. Identify work of separate stages and other logically grouped activities.
   D. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
   E. Indicate delivery dates for owner-furnished products.
   F. Provide legend for symbols and abbreviations used.

3.03  BAR CHARTS
   A. Include a separate bar for each major portion of Work or operation.
   B. Identify the first work day of each week.

3.04  REVIEW AND EVALUATION OF SCHEDULE
   A. Participate in joint review and evaluation of schedule with CMH Architects, Inc. at each submittal.
   B. Evaluate project status to determine work behind schedule and work ahead of schedule.
   C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05  UPDATING SCHEDULE
   A. Maintain schedules to record actual start and finish dates of completed activities.
   B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
   C. Annotate diagrams to graphically depict current status of Work.
D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
E. Indicate changes required to maintain Date of Substantial Completion.
F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE
A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, CMH Architects, Inc., Owner, and other concerned parties.
B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION
SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Mock-ups.
C. Control of installation.
D. Tolerances.
E. Testing and inspection agencies and services.
F. Control of installation.
G. Tolerances.
H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.
B. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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

   2. Test report submittals are for CMH Architects, Inc.'s knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to CMH Architects, Inc., in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

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

E. Manufacturer's Field Reports: Submit reports for CMH Architects, Inc.'s benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
1.04 TESTING AND INSPECTION AGENCIES AND SERVICES
A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 3 EXECUTION
2.01 CONTROL OF INSTALLATION
A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from CMH Architects, Inc. before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have Work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

2.02 MOCK-UPS
A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
B. Accepted mock-ups establish the standard of quality the CMH Architects, Inc. will use to judge the Work.
C. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
E. Obtain CMH Architects, Inc. 's approval of mock-ups before starting work, fabrication, or construction.
   1. CMH Architects, Inc. will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.
F. Accepted mock-ups shall be a comparison standard for the remaining Work.
G. Where mock-up has been accepted by CMH Architects, Inc. and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by CMH Architects, Inc. .

2.03 TOLERANCES
A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from CMH Architects, Inc. before proceeding.
C. Adjust products to appropriate dimensions; position before securing products in place.
2.04 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with CMH Architects, Inc. and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify CMH Architects, Inc. and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by CMH Architects, Inc.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify CMH Architects, Inc. and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by CMH Architects, Inc.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

2.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of CMH Architects, Inc., it is not practical to remove and replace the Work, CMH Architects, Inc. will direct an appropriate remedy or adjust payment.

END OF SECTION
SECTION 014100 – STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.

B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.

3. Requirements for contractor to provide quality-assurance and -control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The owner will engage one or more qualified special inspectors and/or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:

1. 033000 CAST-IN-PLACE CONCRETE.

1.3 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

C. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and/or assembled by the contractor based on the Construction Documents.
D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional’s office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.

E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications:


   a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.

2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the registered design profession in responsible charge for a decision before proceeding.

C. The special inspector’s reports and testing agencies results shall have precedence over reports and test results provided by the contractor.
D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.6 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.

1. Special inspection reports and test results shall include, but not be limited to, the following:
   a. Date of inspection.
   b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
   c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.
      1) Name and signature of contractor’s representative who was notified of work, material, and / or products that do not meet the construction document requirements.
   d. Name and signature of special inspector and / or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CONTRACTOR’S RESPONSIBILITY

A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.
B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.
   1. Contractor shall engage an engineer / architect to prepare repair and / or replacement procedures.
   2. Engineer / architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
   3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.

D. The contractor shall be responsible for costs of:
   1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.
   2. Review of proposed repair and / or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
   3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS
   A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.3 TESTING AND INSPECTION
   A. Testing and inspection shall be in accordance with the attached Schedule of Special Inspections.
   B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

PART 4 - SCHEDULES AND FORMS (ATTACHED)

4.1 STATEMENT OF SPECIAL INSPECTIONS.

4.2 SCHEDULE OF SPECIAL INSPECTIONS. (SEE STRUCTURAL CONTRACT DOCUMENTS)

4.3 FINAL REPORT OF SPECIAL INSPECTIONS.

END OF SECTION 014100
STATEMENT OF SPECIAL INSPECTIONS

Project:
Project Address:
Permit Applicant:
Applicant Address:
Owner:
Owner Address:

Registered Design Professionals (RDP):

Architect:
Geotechnical Engineer:
Structural Engineer:
Mechanical Engineer:
Electrical Engineer:

This statement of special inspections is submitted as a condition for permit issuance in accordance with Chapter 17 of the International Building Code. It includes a Schedule of Special Inspections applicable to the above referenced project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections.

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the building official and to the registered design professional in responsible charge at a frequency agreed upon by the permit applicant and building official prior to the start of work. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and the registered design professional in responsible charge prior to completion of that phase of work. A Final Report of Special Inspections documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted by each agent at the completion of that phase of work.

Maximum frequency of interim report submittals shall not be less than ____________.

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

Owner’s Acknowledgement:

Signature Date

Building Official’s Acceptance:

Signature Date

Permit No.

Frequency of interim report submittals to building official:
To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the Schedule of Special Inspections submitted for permit, have been completed in accordance with the contract documents.

Interim reports submitted prior to this final report and numbered [number] to [number], form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated [date] have been corrected:

(Attach 8 1/2" x 11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

__________________________________________________________
Type or print name

__________________________________________________________
Signature Date
SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Temporary utilities.
B. Temporary telecommunications services.
C. Temporary sanitary facilities.
D. Temporary Controls: Barriers, enclosures, and fencing.
E. Security requirements.
F. Vehicular access and parking.
G. Waste removal facilities and services.
H. Field offices.

1.02  RELATED REQUIREMENTS

1.03  SEE SUPPLEMENTAL GENERAL REQUIREMENTS FOR CITY OF HUNTSVILLE REQUIREMENTS FOR CONTRACTOR TO MAINTAIN OFFICE IN HUNTSVILLE.

1.04  TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
B. Existing facilities may be used. However, there is no guarantee that space will be available. Use of the existing facilities must be coordinated with the owner.
C. New permanent facilities may be used.

1.05  TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Telephone Land Lines: One line, minimum; one handset per line.
   3. Internet Connections: Minimum of one; DSL modem or faster.
   4. Email: Account/address reserved for project use.

1.06  TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
B. Maintain daily in clean and sanitary condition.

1.07  BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
C. Provide protection for plants designated to remain. Replace damaged plants.
D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08  FENCING

A. Construction: Commercial grade chain link fence.
B. Provide 6 foot (1.8 m) high fence around construction site; equip with minimum 2 vehicular 2 pedestrian gates with locks coordinate locations with construction requirements and Owner.
1.09 VEHICULAR ACCESS AND PARKING
   A. Coordinate access and haul routes with governing authorities and Owner.
   B. Provide and maintain access to fire hydrants, free of obstructions.
   C. Provide means of removing mud from vehicle wheels before entering streets.
   D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Coordinate with owner for location of construction personnel parking.

1.10 WASTE REMOVAL
   A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
   B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
   C. Provide containers with lids. Remove trash from site periodically.
   D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
   E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 FIELD OFFICES
   A. Office: Weather tight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
   B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.
   C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
   A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
   B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
   C. Clean and repair damage caused by installation or use of temporary work.
   D. Restore existing facilities used during construction to original condition.
   E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- General product requirements.
- Transportation, handling, storage and protection.
- Product option requirements.
- Substitution limitations and procedures.
- Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- Section 01 1000 - Summary: Lists of products to be removed from existing building.
- Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

1.03 SUBMITTALS

- Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- Provide new products unless specifically required or permitted by the Contract Documents.

2.02 PRODUCT OPTIONS

- Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- DEFINITIONS
  1. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
a. **Substitutions for Cause:** Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

b. **Substitutions for Convenience:** Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

B. **Substitutions for Cause:** Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. **Conditions:** Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Substitution request is fully documented and properly submitted.
   c. Requested substitution will not adversely affect Contractor’s construction schedule.
   d. Requested substitution has received necessary approvals of authorities having jurisdiction.
   e. Requested substitution is compatible with other portions of the Work.
   f. Requested substitution has been coordinated with other portions of the Work.
   g. Requested substitution provides specified warranty.
   h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. **Substitutions for Convenience:** Architect will consider requests for substitution if received within 30 days after the Notice to Proceed.

1. **Conditions:** Architect will consider Contractor’s request for substitution when the following conditions are satisfied:
   a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   b. Requested substitution does not require extensive revisions to the Contract Documents.
   c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   d. Requested substitution will not adversely affect Contractor’s construction schedule.
   e. Requested substitution has received necessary approvals of authorities having jurisdiction.
   f. Requested substitution is compatible with other portions of the Work.
   g. Requested substitution has been coordinated with other portions of the Work.
   h. Requested substitution provides specified warranty.
   i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

D. Substitutions will be considered when a product, through no fault of the Contractor, becomes unavailable or unsuitable due to regulatory change.

E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

F. A request for substitution constitutes a representation that the submitter:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Has made a detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

3. Agrees to provide the same warranty for the substitution as for the specified product.

4. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.

5. Waives claims for additional costs or time extension that may subsequently become apparent.

6. Has made a detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

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


2. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.
F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer’s warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION
SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Examination, preparation, and general installation procedures.
   B. Cutting and patching.
   C. Surveying for laying out the work.
   D. Cleaning and protection.
   E. Starting of systems and equipment.
   F. Demonstration and instruction of Owner personnel.
   G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
   H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS
   A. Refer to Supplemental General Requirements (City of Huntsville) for additional requirement of Huntsville concerning Project Record Documents and Closeout.
   B. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
   C. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
   D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
   E. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
   F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
   G. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
   H. Section 07 8400 - Firestopping.
   I. Individual Product Specification Sections:

1.03 QUALIFICATIONS
   A. For survey work, employ a land surveyor registered in Alabama and acceptable to CMH Architects, Inc. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
   B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Alabama.
   C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Alabama.

1.04 PROJECT CONDITIONS
   A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
   B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
   C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

1.05 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
3.02 PREPARATION
   A. Clean substrate surfaces prior to applying next material or substance.
   B. Seal cracks or openings of substrate prior to applying next material or substance.
   C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK
   A. Verify locations of survey control points prior to starting work.
   B. Promptly notify CMH Architects, Inc. of any discrepancies discovered.
   C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
   D. Promptly report to CMH Architects, Inc. the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
   E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to CMH Architects, Inc.
   F. Utilize recognized engineering survey practices.
   G. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
   H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
      1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and ________
      2. Grid or axis for structures.
      3. Building foundation, column locations, ground floor elevations, and ________
   I. Periodically verify layouts by same means.
   J. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS
   A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
   B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
   C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
   D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
   E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING
   A. Whenever possible, execute the work by methods that avoid cutting or patching.
   B. Perform whatever cutting and patching is necessary to:
      1. Complete the work.
      2. Fit products together to integrate with other work.
      3. Provide openings for penetration of mechanical, electrical, and other services.
      4. Match work that has been cut to adjacent work.
      5. Repair areas adjacent to cuts to required condition.
      6. Repair new work damaged by subsequent work.
      7. Remove samples of installed work for testing when requested.
      8. Remove and replace defective and non-conforming work.
   C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.
D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.08 SYSTEM STARTUP

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

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

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

D. Verify that wiring and support components for equipment are complete and tested.
E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION
A. See Section 01 7900 - Demonstration and Training.

3.10 ADJUSTING
A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING
A. Use cleaning materials that are nonhazardous.
B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
E. Clean filters of operating equipment.
F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and ______.
G. Clean site; sweep paved areas, rake clean landscaped surfaces.
H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES
A. Make submittals that are required by governing or other authorities.
   1. Provide copies to CMH Architects, Inc. and Owner.
B. Notify CMH Architects, Inc. when work is considered ready for CMH Architects, Inc. 's Substantial Completion inspection.
C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for CMH Architects, Inc. 's Substantial Completion inspection.
D. Conduct Substantial Completion inspection and create Final Correction Punch List containing CMH Architects, Inc. 's and Contractor's comprehensive list of items identified to be completed or corrected and submit to CMH Architects, Inc. .
E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
F. Notify CMH Architects, Inc. when work is considered finally complete and ready for CMH Architects, Inc. 's Substantial Completion final inspection.
G. Complete items of work determined by CMH Architects, Inc. listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE
A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.
SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS
   A. Owner requires that this project generate the least amount of trash and waste possible.
   B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
   C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
   D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
   E. Methods of trash/waste disposal that are not acceptable are:
      1. Burning on the project site.
      2. Burying on the project site.
      3. Dumping or burying on other property, public or private.
      4. Other illegal dumping or burying.
   F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS
   A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
   B. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
   C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
   D. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
   E. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS
   A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
   B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
   C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
   D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
   E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
   F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
   G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and CMH Architects, Inc.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.

1. Pre-construction meeting.
2. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

1. As a minimum, provide:
   a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
   b. Recycling bins at worker lunch area.
2. Provide containers as required.
3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION
SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Project Record Documents.
B. Operation and Maintenance Data.
C. Warranties and bonds.

1.02 RELATED REQUIREMENTS
A. Refer to section "Supplemental General Requirements" (provided by city of Huntsville) for additional requirements that may be required.
B. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
C. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
D. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
E. Individual Product Sections: Specific requirements for operation and maintenance data.
F. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS
A. Project Record Documents: Submit documents to CMH Architects, Inc. with claim for final Application for Payment.
B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. CMH Architects, Inc. will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with CMH Architects, Inc. comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection, in addition submit record documents in form and quantity required by the City of Huntsville.
C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS
A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.
F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA
A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES
A. For Each Product, Applied Material, and Finish:
B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS
A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.
B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
E. Provide servicing and lubrication schedule, and list of lubricants required.
F. Include manufacturer's printed operation and maintenance instructions.
G. Include sequence of operation by controls manufacturer.
H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
I. Include test and balancing reports.
J. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of CMH Architects, Inc., Consultants, Contractor and subcontractors, with names of responsible parties.
F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
B. Verify that documents are in proper form, contain full information, and are notarized.
C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.
E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION
SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL
1.01 SUMMARY
   A. Demonstration of products and systems where indicated in specific specification sections.
   B. Training of Owner personnel in operation and maintenance is required for:
      1. All software-operated systems.
      2. HVAC systems and equipment.
      3. Plumbing equipment.
      4. Electrical systems and equipment.
   C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
      1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
      2. Finishes, including flooring, wall finishes, ceiling finishes.
      3. Fixtures and fittings.
1.02 RELATED REQUIREMENTS
   A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
      1. Submit to CMH Architects, Inc. for transmittal to Owner.
      2. Submit not less than two weeks prior to start of training.
      3. Revise and resubmit until acceptable.
      4. Provide an overall schedule showing all training sessions.
      5. Include at least the following for each training session:
         a. Identification, date, time, and duration.
         b. Description of products and/or systems to be covered.
         c. Name of firm and person conducting training; include qualifications.
         d. Intended audience, such as job description.
         e. Objectives of training and suggested methods of ensuring adequate training.
         f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
         g. Media to be used, such as slides, hand-outs, etc.
         h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
   C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
      1. Include applicable portion of O&M manuals.
      2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
      3. Provide one extra copy of each training manual to be included with operation and maintenance data.
   D. Training Reports:
      1. Identification of each training session, date, time, and duration.
      2. Sign-in sheet showing names and job titles of attendees.
      3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
1.04 QUALITY ASSURANCE
   A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
B. Demonstration may be combined with Owner personnel training if applicable.
C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.
B. Provide training in minimum two hour segments.
C. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.
E. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.
F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION
SECTION 023900 - RAMMED AGGREGATE PIERS

PART 1 - GENERAL REQUIREMENTS

1.1 DESCRIPTION

A. Work shall consist of designing, furnishing and installing Rammed Aggregate Pier elements to the lines and grades designated on the project foundation plan and as specified herein. The aggregate pier elements shall be constructed by compacting aggregate in an excavated hole using special high-energy impact densification equipment. The aggregate pier elements shall be in a columnar-type configuration and shall be used to reinforce soils for the support of high bearing pressure spread footings.

1.2 WORK INCLUDED

A. Provision of all equipment, material, labor, and supervision to design and install rammed aggregate pier elements. Design shall rely on subsurface information presented in the project geotechnical report (Rammed Aggregate Pier Designer/Contractor is responsible for obtaining a copy of the project’s geotechnical report). Layout of aggregate pier elements, removal of spoils from the site, (which result from aggregate pier construction), and removal of spoils off the working pad, footing excavation, and subgrade preparation following aggregate pier installation is not included.

B. Drawings and General Provisions of the Contract, including General and Supplemental conditions, and Division 1 Specifications, apply to the work in this specification.

1.3 APPROVED INSTALLERS

A. Installers of Rammed Aggregate Pier Foundation Systems shall have a minimum of 5 years of experience with the installation of aggregate piers and shall have completed installations for at least 50 buildings or structures.

B. Installers shall be licensed by Geopier Foundation Company, Inc. (or approved equal) and shall have demonstrated experience in the construction of similar size and types of projects. The rammed aggregate pier Installer shall be approved by the Owner’s Engineer prior to bid opening. The Installer shall adhere to all methods and standards described in this Specification.

C. Information regarding contractors licensed to install Rammed Aggregate piers can be obtained by contacting Geopier Foundation Company. (901-309-3363 or 800-371-7470) (or an approved equal.)

1.4 RELATED WORK

A. Division 2 Section - Earthwork
B. Division 0 Section – Information Available to Bidders

C. Division 3 Section – Cast-In-Place Concrete

1.5 REFERENCE STANDARDS

A. Design

B. Modulus and Uplift Testing
1. ASTM D-1143 – Pile Load Test Procedures
2. ASTM D-1194 – Spread Footing Load Test
3. ASTM-D-3689 – Uplift Load Test

C. Materials and Inspection
1. ASTM D-1241 – Aggregate Quality
2. ASTM STP 399 – Dynamic Penetrometer Testing
3. ASTM D-422 – Gradation Soils

1.6 CONFLICTS IN SPECIFICATIONS/REFERENCES

A. Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of the applicable document.
1.7 CERTIFICATIONS AND SUBMITTALS

A. The installer shall submit detailed design calculations and construction drawings prepared by the Rammed Aggregate Pier Designer (the Designer) to the Owner or Owner’s Engineer for approval at least 4 weeks prior to the start of construction. All plans and calculations shall be sealed by a Professional Engineer in the State where the project located.

B. The Rammed Aggregate Pier Designer shall have Errors and Omissions design insurance for the work. The insurance policy should provide a minimum coverage of $2 million per occurrence.

C. Modulus and uplift test data - The Installer shall furnish the General Contractor a description of the installation equipment, installation records, complete test data, analysis of the test data and recommended design parameter values based on the modulus test results. The report shall be prepared under supervision of a registered professional engineer.

D. Daily Rammed Aggregate Pier Progress Reports – The Installer shall furnish a complete and accurate record of aggregate pier installation to the General Contractor. The record shall indicate the pier location, length, average lift thickness and final elevations of the base and top of piers. The record shall also indicate the type and size of the densification equipment used. The Installer shall immediately report any unusual conditions encountered during installation to the General Contractor, to the Designer and to the Testing Agency.

1.8 METHOD OF MEASUREMENT

A. Measurement of the aggregate pier elements is on a per-pier basis.

B. Payment shall cover design and installation of the aggregate pier foundation system. Excavation of unsuitable materials, drilling obstructions, delays, and remobilization as documented and approved by the Owner or Owner’s Engineer shall be paid for under separate pay items.

C. Quantities of piers, as shown on Rammed Aggregate Pier Designer’s plans, may be increased or decreased at the direction of the Owner or Owner’s Engineer, based on construction procedures and actual site conditions.

1.9 BASIS OF PAYMENT

A. The accepted quantities of piers will be paid per approval, in-place aggregate-pier.

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of plans and specifications and installation of ___ aggregate pier elements.</td>
<td>$______________ Lump Sum</td>
</tr>
</tbody>
</table>

B. Additional unit prices below shall be written on the Bid Tab:
Additional Installed Piers (w/o remobilization) $ Each
Add for Casing Holes $ /Linear Foot
Additional Mobilizations $ Each
Additional Modulus or Uplift Load Tests $ Each.

C. Base price shall not be exceeded without first obtaining approval by the Architect as well as providing significant reasons why the base price is exceeded. The unit price should be developed based on the quantities and parameters on which the base price is calculated. Only for piers exceeding the quantities due to unforeseen conditions should any extra payment be allowed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate used for piers constructed above the water table shall be Type I Grade B in accordance with ASTM D-1241-68, or shall be other graded aggregate selected by the Installer and successfully used in the modulus test. It shall be compacted to a densification and strength, which provides resistance to the dynamic penetration test (ASTM STP 399) of a minimum average of 15 blows per 1.75-inch vertical movement.

B. For aggregate used for piers constructed below the water table, the gradation shall be the same as Type I Gradation B, except that particles passing the No. 40 sieve shall be eliminated. Alternatively, No.57 stone or other stone selected by the Aggregate Pier Installer may be used. Dynamic penetration resistance testing is inappropriate for this material.

C. Potable water or other suitable source shall be used to increase aggregate moisture content where required. The General Contractor shall provide such water to the Installer.

D. The General Contractor will provide adequate and suitable marshalling areas on the project site for the use of the Installer for the storage of aggregate and equipment.

PART 3 - DESIGN REQUIREMENTS

3.1 RAMMED AGGREGATE PIER DESIGN

A. The Rammed Aggregate Pier elements shall be designed for an Aggregate Pier stiffness modulus of 175 pci. The stiffness modulus value shall be verified by the results of the Rammed Aggregate Pier modulus test, described in this specification.

B. Aggregate piers shall be designed in accordance with generally-accepted engineering practice and the methods described in Section 1 of these Specifications. The design shall meet the following criteria.
Maximum Allowable Bearing Pressure for
Aggregate Pier Reinforced Soils 5,000 psf
Estimated Total Long-Term Settlement for Footings: ≤1 - inch
Estimated Long-Term
Differential Settlement of Adjacent Footings: ≤3/4 - inch

C. The design submitted by the Installer shall consider the bearing capacity and settlement of all footings supported by aggregate piers, and shall be in accordance with acceptable engineering practice and these specifications. Total and differential settlement shall be considered. The design life of the structure shall be 50 years.

D. The Rammed Aggregate Pier system shall be designed to preclude plastic bulging deformations at the top-of-pier design stress and to preclude significant tip stresses as determined from the shape of the telltale test curve from telltales installed in modulus test piers.

3.2 DESIGN SUBMITTAL
A. The Installer shall submit 4 sets of detailed design calculations, construction drawings, and shop drawings, (the Design Submittal), for approval at least 4 weeks prior to the beginning of construction. A detailed explanation of the design parameters for settlement calculations shall be included in the Design Submittal. Additionally, the quality control test program for aggregate piers, meeting these design requirements, shall be submitted. All calculations and drawings shall be prepared and sealed by a Professional Engineer, licensed in the State or Province where the piers are to be built.

3.3 BUILDING CODE ACCEPTANCE
A. The Rammed Aggregate Pier Installer shall demonstrate that the Aggregate Pier system has been ICBO certified.

PART 4 - CONSTRUCTION

4.1 EXCAVATION
A. All Rammed Aggregate Pier elements shall be pre-augered using mechanical drilling or excavation equipment. Installation of piers without pre-augering shall not be allowed because this technique results in significant disturbance and remolding of the matrix soils surrounding the piers.

B. If cave-ins occur during excavation such that the sidewalls of the hole are deemed to be unstable, steel casing or a drilling slurry shall be used to stabilize the excavation.

C. If cave-ins occur on top of a lift of aggregate such that the volume of the caved soils is greater than 10 percent of the volume of the aggregate in the lift, then the aggregate shall be considered
contaminated and shall be removed and replaced with uncontaminated aggregate.

4.2 DENSIFICATION

A. Special high-energy impact densification apparatus shall be employed to densify the Rammed Aggregate Pier elements during installation. The apparatus shall apply direct downward impact energy to each lift of aggregate.

B. The bottom of the excavation shall be densified prior to the placement of the aggregate. If wet, soft or sensitive soils are present, open-graded aggregate, such as ASTM No.57 stone or other, shall be placed at the bottom of the excavation and compacted to stabilize the element bottom and may serve as the initial lift.

C. Densification shall be performed using a beveled tamper or equivalent down-hole vibrator. The beveled tamper foot (or equivalent) is required to adequately increase the lateral earth pressure in the matrix soil during installation.

D. Downward pressure shall be applied to the tamper shaft during tamping.

E. Each lift of aggregate shall be tamped for a minimum of 10 seconds.

4.3 PLAN LOCATION AND ELEVATION OF RAMMED AGGREGATE PIER ELEMENTS

A. The center of each pier shall be within six inches of the plan locations indicated. The final measurement of the top of piers shall be the lowest point on the aggregate in the last compacted lift. Piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the Owner.

4.4 REJECTED RAMMED AGGREGATE PIER ELEMENTS

A. Rammed Aggregate pier elements improperly located or installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers, unless the Designer approves other remedial measures. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner, unless the cause of the rejection is due to an obstruction or mislocation.

PART 5 - QUALITY CONTROL

5.1 QUALITY CONTROL REPRESENTATIVE

A. The Installer shall have a full-time Quality Control (QC) representative to verify and report all QC installation procedures. The Installer shall immediately report any unusual conditions encountered during installation to the Design Engineer, the General Contractor, and to the Testing Agency. The QC procedures shall include the preparation of Aggregate Pier Progress Reports completed during each day of installation and containing the following information:
1. Footing and Rammed Aggregate Pier location.
2. Rammed Aggregate Pier length and drilled diameter.
3. Planned and actual Rammed Aggregate Pier elevations at the top and bottom of the element.
4. Average lift thickness for each Rammed Aggregate Pier.
5. Soil types encountered at the bottom of the Rammed Aggregate Pier and along the length of the element.
6. Depth to groundwater, if encountered.
7. Documentation of any unusual conditions encountered.
8. Type and size of densification equipment used.

5.2 MODULUS TEST

A. A modulus test shall be performed to verify the parameter values selected for design. The modulus tests shall be of the type and installed in a manner specified herein.

B. A telltale shall be installed at the bottom of the test pier so that bottom-of-pier deflections may be determined. Acceptable performance is indicated when the bottom of the pier deflection is no more than 20% of the top of pier deflection at the design stress level.

C. ASTM D-1143 general test procedures shall be used as a guide to establishing load increments, load increment duration, and load decrements.

D. With the exception of the load increment representing approximately 115% of the design maximum top of Aggregate Pier stress, all load increments shall be held for a minimum of 15 minutes, a maximum of 1 hour, and until the rate of deflection reduces to 0.01 inch per hour, or less.

E. The load increment that represents approximately 115% of the design maximum stress on the Aggregate Pier shall be held for a minimum of 15 minutes, a maximum of 4 hours and until the rate of deflection reduces to 0.01 inches per hour or less.

F. A seating load equal to 5 percent of the total load shall be applied to the loaded steel plate prior to application of load increments and prior to measurement of deflections to compensate for surficial disturbance.

G. Rammed Aggregate Pier modulus testing shall be performed in accordance with the requirements outlined in the Design Submittal.

H. The location of the aggregate pier modulus test should be coordinated with the project Geotechnical Engineer of record.

5.3 BOTTOM STABILIZATION VERIFICATION TEST

A. After completion of the bottom pier bulb, or at any time during the process of constructing the pier, the energy source may be turned off, and bottom stabilization verification test may be performed. These tests shall be performed when a new soil formation is encountered, or at the beginning of a project to provide quantitative information on pier stabilization.
B. Bottom Stabilization Tests are performed by placing a reference bar over the cavity, marking the tamper shaft, applying energy to the tamper for an additional 15 seconds, and observing the downward deflection of the tamper shaft by observing the deflection of the mark on the tamper shaft.

C. Acceptable performance is indicated if the vertical movement of the shaft is less than 150% of the vertical movement measured for the modulus test pier.

D. If the measured vertical movement exceeds 150% of the value achieved during the modulus test, added energy is applied to re-densify the bulb. The procedure for measure is then repeated. If there is still movement greater than 150% of that achieved during the modulus test and greater than \( \frac{1}{2} \) inch, a lift of loose aggregate may be placed on top of the compacted aggregate, and the verification test may be performed on this next lift after it is densified. If there is excessive movement on this lift, another lift may be placed and tested. Movement must be limited to below 150% of the values achieved for the modulus test before completion of 2/3 of the pier depth.

5.4 DYNAMIC CONE PETROMETER TEST

A. The Rammed Aggregate Pier elements shall be tested by the Dynamic Cone Penetrometer method (ASTM STP 399) at locations within the upper 1/3 of the pier shaft length.

B. The minimum acceptable criteria as an indicator of acceptable densification shall be at least 15 blows per 1-3/4 inch penetration.

C. Dynamic Cone Penetrometer testing shall be performed in each Aggregate Pier until such time as five consecutive tests indicate that the minimum criterion is met. Thereafter, such tests need not be performed on every pier, provided that the aggregate used in the elements is representative of that previously tested. If average penetration resistances measured exceed 15 blows, and less than 10% of tests fall below 15 blows, then testing may be reduced to spot checks. A pattern of successful tests is sufficient to reduce testing to several tests per day.

D. Observation of questionable aggregate moisture content or questionable aggregate gradation appearance may determine the need for additional dynamic penetration testing to verify that the proper densification is being achieved.

E. Use of Dynamic Cone Penetrometer is not appropriate for use on open-graded aggregate such as No. 57 stone.

PART 6 - QUALITY ASSURANCE

6.1 INDEPENDENT TESTING AGENCY

A. The Owner is responsible for retaining an independent testing firm to provide Quality Assurance services. The Testing Agency should be the Geotechnical Engineer of Record.
6.2 RESPONSIBILITIES OF INDEPENDENT TESTING AGENCY

A. The Testing Agency shall monitor the modulus and uplift test(s) when modulus or uplift test(s) are to be performed. The Installer shall provide and install all dial indicators and other measuring devices.

B. The Testing Agency shall monitor the installation of aggregate pier elements to verify that the production installation practices are similar to those used during the installation of the modulus test elements.

C. The Testing Agency shall perform Dynamic Cone Penetrometer tests as described herein.

D. The Testing Agency shall report any discrepancies to the Installer and General Contractor immediately.

PART 7 - RESPONSIBILITIES OF GENERAL CONTRACTOR

7.1 PREPARATION

A. The General Contractor shall locate and protect underground and aboveground utilities and other structures from damage during installation of the Aggregate Pier elements.

B. The General Contractor will provide the site to the Installer, after earthwork in the area has been completed.

C. Site subgrade shall be established by the General Contractor within 6 inches of final design subgrade, as approved by the Design Engineer.

D. A working surface will be established and maintained by the General Contractor to provide wet weather protection of the subgrade and to provide access for efficient operation of the Aggregate Pier installation.

7.2 LAYOUT OF RAMMED AGGREGATE PIER ELEMENTS

A. The General Contractor shall provide layout (construction staking) of the Aggregate Piers. The General Contractor shall provide ground elevations in sufficient detail to estimate drilling depth elevations to within 2 inches.

7.3 RAMMED AGGREGATE PIER EXCAVATION

A. Should any obstruction be encountered during drilling or excavation for aggregate piers, the General Contractor shall be responsible for removing such obstruction, or the pier shall be relocated or abandoned. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., that prevent installing the aggregate piers to the required depth, or cause the aggregate pier to drift from the required locations. Dense natural rock or weathered rock shall not be deemed obstructions, and piers may be terminated short of design
lengths on such materials. If the General Contractor cannot or does not remove such obstructions within one hour from the time the Installer reports the obstruction to the General Contractor, the Installer may remove such obstructions with his own means. Should this occur, the Installer shall receive an extra to the contract to account for their additional expenses, including delay time involved to crew and equipment.

7.4 UTILITY EXCAVATIONS

A. The General Contractor shall coordinate all excavations made subsequent to Aggregate Pier installations so that at least five feet of horizontal distance remains between the edge of any installed Aggregate Pier and the excavation. Protection of completed Aggregate Pier elements is the responsibility of the General Contractor. In the event that utility excavations are required at horizontal distances of less than five feet from installed Aggregate Piers, the General Contractor shall contact the Aggregate Pier Designer to develop construction solutions to minimize impacts on the installed Aggregate Piers.

B. Recommended procedures may include:

1. Using cement-treated base to construct portions of the Aggregate Piers subject to future excavations.
2. Replacing excavated soil with compacted crushed stone in the portions of excavations where the Aggregate Piers have been disturbed. The placement and compaction of the crushed stone shall meet the following requirements.
   a. The crushed stone shall meet the gradation specified by the Designer.
   b. The crushed stone shall be placed in a controlled manner using motorized impact compaction equipment.
   c. The aggregate should be compacted to 95% of the maximum dry density as determined by the modified Proctor method (ASTM D-1557).
   d. The Testing Agency shall be on site to observe placement, compaction, and provide density testing. The test results shall be submitted to the Designer and the General Contractor. The General Contractor shall provide notification to the Testing Agency and the Designer when excavation, placement, and compaction will occur and arrange for construction observation and testing.

7.5 EXCAVATIONS

A. The General Contractor shall coordinate all excavations made subsequent to Aggregate Pier installations so that at least five feet of horizontal distance remains between the edge of any installed Rammed Aggregate Pier and the excavation. Protection of completed Aggregate Pier elements is the responsibility of the General Contractor. In the event that utility excavations are required at horizontal distances of less than five feet from installed Aggregate Piers, the General Contractor shall contact the Aggregate Pier Designer to develop construction solutions to minimize impacts on the installed Aggregate Piers.

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   4.) The Testing Agency shall be on site to observe placement, compaction, and provide density testing. The test results shall be submitted to the Designer and the General Contractor. The General Contractor shall provide notification to the Testing Agency and the Designer when excavation, placement, and compaction will occur and arrange for construction observation and testing.

7.6 PROTECTION OF THE WORK

A. Upon completion of rammed aggregate pier installations, the General Contractor is responsible for protection of the work. This includes, but is not limited to, proper site drainage to prevent the collection or ponding of water on or near completed rammed aggregate piers and appropriate control and coordination of earthwork activities and/or subsequent drilling activities in order to prevent damage to completed rammed aggregate piers.

7.7 FOOTING BOTTOMS

A. Excavation and surface compaction of all footings shall be the responsibility of the General Contractor.

B. Foundation excavations to expose the tops of Aggregate Pier elements shall be made in a workmanlike manner, and shall be protected until concrete placement, with procedures and equipment best suited to (1) prevent softening of the matrix soil between and around the Aggregate Pier elements before pouring structural concrete, and (2) achieving direct and firm contact between the dense, undisturbed Aggregate Pier elements and the concrete footing.

C. Recommended procedures for achieving these goals are to:
   1. Limit over-excavation below the bottom of the footing to 3-inches (including disturbance from the teeth of the excavation equipment,
   2. Compaction of surface soil and top of Aggregate Pier elements shall be prepared using a motorized impact compactor (“Wacker Packer,” “Jumping Jack,” or similar). Sled-type tamping devices shall not be used. Compaction shall be performed over the entire footing bottom to compact any loose surface soil and loose surface pier aggregate.
3. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on expansive or sensitive soils.

4. If same day placement of footing concrete is not possible, place a minimum 3-inch thick lean concrete seal ("mud mat") immediately after the footing is excavated and approved.

D. The following criteria shall apply, and a written inspection report sealed by the project Geotechnical Engineer shall be furnished to the Installer to confirm:

1. That water (which may soften the unconfined matrix soil between and around the Aggregate Pier elements, and may have detrimental effects on the supporting capability of the Aggregate Pier reinforced subgrade) has not been allowed to pond in the footing excavation at any time.

2. That all Aggregate Pier elements designed for each footing have been exposed in the footing excavation.

3. That immediately before footing construction, the tops of all the Aggregate Pier elements exposed in each footing excavation have been inspected and recompacted as necessary with mechanical compaction equipment, and that the tops of any Aggregate Pier elements which may have been disturbed by footing excavation and related activity have been recompacted to a dry density equivalent to at least 95% of the maximum dry density obtainable by the modified Proctor method (ASTM D-1557).

4. That no excavations or drilled shafts have been made after installation of Aggregate Pier elements within horizontal distance of five feet from the edge of any pier, without the written approval of the Installer or Designer.

E. Failure to provide the above inspection and certification by the project Geotechnical Engineer, which are beyond the responsibility of the Aggregate Pier Installer, may void any written or implied warranty on the performance of the Aggregate Pier system.

7.8 UNACCEPTABLE PIERS

A. Unacceptable Piers: Piers that fail, are placed out of position, are below elevations, or are damaged.

B. Provide additional piers or replace piles failing to conform to specified requirements.

7.9 DISPOSAL OF MATERIALS

A. Remove surplus excavated material and slurry and legally dispose of it off Owner's property.

END OF SECTION 023900
SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.
E. Samples: For waterstops vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Waterstops.
   6. Curing compounds.
   7. Floor and slab treatments.
   10. Vapor retarders.
   11. Semirigid joint filler.

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.

2. ACI 117.
2.2 FORM-FACING MATERIALS
   A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
      1. Plywood, metal, or other approved panel materials.
   B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
   C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
   E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
   F. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   G. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.3 STEEL REINFORCEMENT
   A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
   B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
   C. Deformed-Steel Wire: ASTM A 1064/A 1064M.
   D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES
   A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
   B. Zinc Repair Material: ASTM A 780/A 780M.
C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

2. Fly Ash: ASTM C 618, Class F or C.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. BASF Corporation; Admixture Systems.
b. Euclid Chemical Company (The); an RPM company.
c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
d. Sika Corporation.

G. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. BASF Corporation; Admixture Systems.
   b. Cortec Corporation.
   c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
   d. Sika Corporation


2.6 WATERSTOPES

A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Profile: Flat dumbbell with center bulb.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. JP Specialties, Inc.
      b. Sika Corporation.

C. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. BoMetals, Inc.
      b. Paul Murphy Plastics Company.
      c. Sika Greenstreak.
d. Vinylex Waterstop and Accessories.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Barrier-Bac; Inteplast Group, Ltd.
   b. Carlisle Coatings & Waterproofing Inc.
   c. CETCO, a Minerals Technologies company.
   d. Concrete Sealants Inc.
   e. Henry Company.
   f. JP Specialties, Inc.
   g. Sika Greenstreak.

E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Adeka Ultra Seal/OCM, Inc.
   b. CETCO, a Minerals Technologies company.
   c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
   d. Sika Greenstreak.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class C, 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Barrier-Bac; Inteplast Group, Ltd.
   c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
   d. Insulation Solutions, Inc.
   e. Poly-America, L.P.
   f. Raven Industries, Inc.
   g. Reef Industries, Inc.
   h. Stego Industries, LLC.
   i. Tex-Trude, Inc.
   j. W. R. Meadows, Inc.
2.8 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. AWRC Corporation.
   b. BASF Corporation; Admixture Systems.
   c. Euclid Chemical Company (The); an RPM company.
   d. Kaufman Products, Inc.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. BASF Corporation; Admixture Systems.
   b. Dayton Superior.
   c. Euclid Chemical Company (The); an RPM company.
   d. Kaufman Products, Inc.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Anti-Hydro International, Inc.
   b. BASF Corporation; Admixture Systems.
   c. Dayton Superior.
   d. Euclid Chemical Company (The); an RPM company.
   e. Kaufman Products, Inc.
F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Anti-Hydro International, Inc.
   b. BASF Corporation; Admixture Systems.
   c. Dayton Superior.
   d. Euclid Chemical Company (The); an RPM company.
   e. Kaufman Products, Inc.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. AWRC Corporation.
   b. BASF Corporation; Admixture Systems.
   c. Dayton Superior.
   d. Euclid Chemical Company (The); an RPM company.

H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. BASF Corporation; Admixture Systems.
   b. Dayton Superior.
   c. Euclid Chemical Company (The); an RPM company.
   d. Kaufman Products, Inc.

I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. AWRC Corporation.
   b. Dayton Superior.
   c. Euclid Chemical Company (The); an RPM company.
   d. Kaufman Products, Inc.
2.10 RELATED MATERIALS


B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlay: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

3.5 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.
B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.8 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

   3. Cork-Float Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
   
a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade. If leveling is required, use Ardex leveling agent. Submit product information prior to use.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 3000 psi at 28 days.
4. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after
loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENT APPLICATION

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through un-reinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000
SECTION 034100

PLANT PRECAST CONCRETE

PART 1  GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Precast structural concrete.
2. Precast structural concrete with commercial architectural finish.

B. Related Sections:

1. Division 01 Section “Special Inspection Services” for administrative and procedural requirements for special inspection services.
2. Division 03 Section “Cast-in-Place Concrete” for concrete topping and placing connection anchors in concrete.
3. Division 04 Section “Unit Masonry” for inserts or anchorages required for precast concrete slab connections.
4. Division 07 Section “Joint Sealants” for elastomeric joint sealants and sealant backings.

1.3 DEFINITION


1.4 PERFORMANECE REQUIREMENTS
A. Delegated Design: Design precast structural concrete, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide precast structural concrete units and connections capable of withstanding design loads indicated within limits and under conditions indicated.

1. Design precast structural concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of ACI 318.

   a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of minus 18 to plus 120 deg F.

2. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

3. Vehicular Impact Loads: Design spandrel beams acting as vehicular barriers for passenger cars to resist a single 6000-lbf service load and 10,000-lbf ultimate load applied horizontally in any direction to the spandrel beam, with anchorages or attachments capable of transferring this load to the structure. Design spandrel beams assuming the load to act at heights of 18 inches and 27 inches above the floor or ramp surface on an area not to exceed 1 sq. ft.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s specifications and instructions for manufactured materials and products. Include manufacturer’s certifications and laboratory test reports as required.

B. Mix Designs: Submit written reports of proposed concrete mix and specified in Part-2 of this section.

C. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

   Indicate layout, dimensions, and identification of each precast unit corresponding sequence and procedure of installation. Indicate welded connections by AWS
standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.

Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.

Include erection procedure for precast units and sequence of erection.

Provide complete design calculation prepared by a registered engineer, licensed in the state in which the project is built.

1.6 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated:

1. ACI 301 – Specifications for Structural Concrete for Buildings.
2. ACI 318 – Building Code Requirements for Reinforced Concrete.
4. Prestressed Concrete Institute MNL 116 - Manual for Quality Control for Plants and Production of Precast Concrete Products.

B. Fabricator Qualifications: Firms which have 5 years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.

Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and / or participate in its Plant Certification Program.

Approved Fabricator:
Tindall Corporation……Contact:

C. Design by Fabricator: Precast units are to be designed and reinforced for all loading conditions they will experience, including handling and erection stresses. The units and their connections shall be capable of safely resisting maximum wind loads per the latest edition of the Building Code. For other loading conditions (such as tributary wind from window glazing, and reactions from lintel support beams) see the drawings. The in-service deflection limitation for each member is 1/360 of its unsupported length.
D. Fabrication Qualifications: Produce precast concrete units at fabricating plant engaged primarily in manufacturing of similar units, unless plant fabrication or delivery to project site is impractical due to height, width or weight restrictions.

If units are not produced at precast concrete fabricating plant, maintain procedures and conditions for quality control which are equivalent to plant production.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.

B. Deliver anchorage items that are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

PART2 PRODUCTS

2.1 FORMWORK

A. Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.

B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.

Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, uncoated.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706.

C. Steel Wire: ASTM A82, plain, cold-drawn, steel.

E. Welded Deformed Steel Wire Fabric: ASTM A497.

F. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.

   For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.3 PRESTRESSING TENDONS

   A. Uncoated, 7-wire stress-relieved strand complying with ASTM A416. Use Grade 270.

   B. Strand similar to above, but having size and ultimate strength of wires increased so that ultimate strength of the strand is increased approximately 15 percent, or strand with increased strength but with fewer number of wires per strand, may be used manufacturer’s option.

2.4 CONCRETE MATERIALS

   A. Portland Cement: ASTM C150, Type I or Type III. Use only one brand and type of cement throughout project, unless otherwise acceptable to Architect.

   B. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 6 percent.

   C. Aggregates: ASTM C33, and as herein specified. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Architect.

   D. Water: Potable.


   F. Water-Reducing Admixture: ASTM C494, Type A, or other Type approved for fabricator’s units.
2.5 CONNECTION MATERIALS

A. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A36.

B. Steel Shapes: ASTM A36.

C. Anchor Bolts: ASTM A36, low-carbon steel bolts, heavy hexagon nut and carbon washers.

D. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon bolts, and hardened washers complying with ASTM A325.

E. Finish of Steel Units: Items exposed to interior are painted with rust-inhibitive primer after installation. Items exposed to exterior are to be avoided. Where items are exposed, apply hop-dip galvanizing.

F. Welding Electrodes: Comply with AWS standards, E70XX.

G. Accessories: Provide clips, hangers, and other accessories required for installation of project units and for support of subsequent construction or finishes.

2.6 GROUT MATERIALS


B. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621

Products: Subject to compliance with requirements, provide one of the following:

- Dayton Grout: Dayton Superior
- Euco N.S.: Euclid Chemical Co.
- Masterflow 713: Master Builders.

2.7 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete required.

B. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer’s option.
C. Proportion mixes by either laboratory trail batch or field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 318.

Product standard-weight concrete consisting of specified Portland cement, aggregates, admixtures, and water to produce the following properties:

Compressive strength; 5000 psi minimum at 28-days. Release strength for prestressed units: 3000 psi minimum at 8 hours.

Cure compression test cylinders using the same methods as used for precast concrete work.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using the work.

E. Admixtures:

Use air-entraining admixture in concrete, unless otherwise indicated. Use ACI 318 Chapter 4 to determine exposure and determine air entrainment requirements. Tindall shall target 6% ± 2% entrained.

Use water-reducing admixtures in strict compliance with manufacturer’s directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect’s acceptance.

Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.9 FABRICATION / GENERAL

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, and as specified for types of units required.

B. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or placing of concrete.
C. Cast-in holes for openings larger than 10” diameter or 10” square in accordance with final shop drawings. Other smaller holes will be field cut by trades requiring them, as acceptable to Architect.

D. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer’s instructions.

E. Clean reinforcement of loose rust and mill scale, earth and other materials which reduce or destroy bond with concrete.

F. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runner, bolsters, spacers and hangers, as required.

G. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

H. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.

I. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304.

   Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

J. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface which will not show in finished structure.

K. Curing by low pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

L. Delay detensioning of prestressed units until concrete has attained at least 60 percent of design stress, as established by test cylinders.
If concrete has been heat-cured, perform detensioning while concrete is still warm and moist, to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.

Detensioning of pretensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

M. Finish of Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:

Reveals: Incorporate horizontal and vertical reveals as shown on drawings.

Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.

N. Finish of Unformed Surfaces:

1. Light broom Finish- Unformed surface of all walls, spandrels, factory topped double tees, flat slabs not receiving additional topping in the field by others.

2. Rake Finish- Unformed surface of all beams, double tees, flat slabs and landings designed to receive topping in the field by others.

3. Float Finish- Unformed surface of all flat slab roof members.

4. Steel Trowel Finish- Unformed surface of all columns.

5. Architectural Grade “A” Finish- on the three-formed surfaces of all columns.

6. Stair & Elevator walls- Light broom finish (unless otherwise noted)

O. Mockup: Before producing precast structural concrete with commercial architectural finish, build a mockup to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Manufacture mockups to comply with the following requirements, using materials indicated for the completed work:

1. Sample Panel: Precast concrete fabricator shall make 4’x4” (unless otherwise requested) of a typical section for finish selection only. A return detail shall be included if applicable. If multipole architectural mixes or finish details exist, additional mockups may be required. Sample panel will be reviewed at precast plant by Engineer/Architect/Owner: If rejected, another set of sample panels shall be made for review, until acceptable sample is made. If accepted, sample panel shall be held at plant until production is complete, then shipped to site.
(if required) and held there until completion and acceptance of project, when Contractor shall remove it from site.

2. Notify Engineer/Architect several days in advance of dates and times when mockups will be constructed.

3. Obtain Engineer/Architect’s approval of mockups before starting fabrication.

4. At precaster’s plant, maintain mockups during fabrication in an undisturbed condition as a standard for judging the completed work.

2.10 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.

2.11 SOURCE QUALITY CONTROL

A. The Owner may employ a separate testing laboratory to evaluate precast manufacturer’s quality control and testing methods.

B. The precast manufacturer shall allow Owner’s testing facility access to materials storage areas, concrete production equipment and concrete placement and curing facilities. Cooperate with Owner’s testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits, will be subject to additional testing as herein specified.

Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.

D. Strength of units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions:

Failure to meet compressive strength tests requirements.
Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.

Concrete curing, and protection of precast units against extremes in temperature, not as specified.

Precast units damaged during handling and erection.

E. Testing Precast Units: When there is evidence that is strength of precast concrete units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42 and as follows:

Take at least 3 representative cores from precast units of suspect strength, from locations directed by Architect.

Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet curing use of completed structure.

Test cores in an air-dry condition per ACI 318 if concrete will be dry during use of completed structure.

Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent of 28-day design compressive strength.

Test results will be made in writing on same day that tests are made, with copies to Architect, Contractor, and precast manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, name, and type of member or members represented by core tests, design compressive strength compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.

F. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

G. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be repaired or replaced with precast concrete units that meet requirements of this section. Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.
PART3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary member and connections when permanent members are in place and final connections are made.

B. Welding: Perform welding in compliance with AWS D1.1, including qualification of welders.

Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.

Repair damaged metal surfaces by cleaning and applying a cost of compatible primer to painted surfaces.

C. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

D. Erection Tolerances: Install precast units without exceeding following tolerance limits specified in PCI MNL-127 “Recommended Practice for Erection of Precast Concrete”.

Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at base of unit as follows:

Shrinkage-resistant grout consisting of premixed compound and water to provide a flowable mixture without segregation or bleeding.

Provide forms or other acceptable method to retain grout in place unit sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

3.2 FIELD QUALITY CONTROL
A. Erection of precast concrete units shall be inspected for compliance with contract drawings and erection drawings per Section 01400.

3.3 PRECASTOR TO INCLUDE THE FOLLOWING ITEMS WITHIN THERE CONTRACTED SCOPE OF WORK:

A. Double tee’s to be provide as factory topped system with washes produced in the plant prior to bringing into jobsite. The wash shall poured in the plant as part of the double tee.

B. Precastor to include within their contracted scope of work to provide all Cast In Place over the beams, stair tower openings, elevator, etc. Any CIP on the elevated level required by the precastor’s design is to be designed, provided & installed by selected precastor.

C. Precastor to include within their contracted scope of work to provide all precast to precast joints caulked using a polyurethane caulk. Baker rods to be installed prior in all precast joints. This includes all vertical & horizontal caulk.

D. Precastor to include within their contracted scope of work to provide all cable barrier along the ramp wall & exterior elevations as indicated. Precast to design, provide & install all cable barrier required on the project.

E. All floor drains on the elevated precast level are to be cast in at the plant by the precastor. The precastor is ship product with all floor drains installed on the elevated level.

F. Precastor to provide an architectural sandblast finish using gray concrete along 4.2 & 4.3 line along the north elevation. Samples to provided.

END OF SECTION
SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Concrete Block.
   B. Mortar and Grout.
   C. Reinforcement and Anchorage.
   D. Flashings.
   E. Accessories.

1.02 RELATED REQUIREMENTS
   A. Section 05 5000 - Metal Fabrications: Loose steel lintels.
   B. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.
   C. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.
   D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS
   F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
   C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
   D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

G. Masonry Reinforcement Submittal: Provide shop drawings and erection drawings for concrete masonry reinforcing. Detail and provide reinforcing bars details in accordance with ACI Detailing Manual SP-66. Provide plans, sections, and elevations showing layout of reinforcing and masonry elements.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Increase extent of cover in first subparagraph below as needed to suit local climatic conditions.
   2. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
   3. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.


PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS
   A. Concrete Block: Comply with referenced standards and as follows:
      1. Size: Standard units with nominal face dimensions as indicated on the drawings.
      2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, and control joint edges.
      3. Load-Bearing Units and Other Structural Units: ASTM C90, normal weight.
         a. Hollow block, as indicated. Minimum unit net compressive strength of 1900 psi.
         b. Exposed Faces: Manufacturer's standard color and texture where indicated.
         a. Hollow block, as indicated.
         b. Normal weight.

2.02 MORTAR AND GROUT MATERIALS
   A. Masonry Cement: ASTM C91/C91M, Type S.
      1. Colored Mortar: Premixed cement as required to match CMH Architects, Inc. ’s color sample.
      2. Manufacturers:
         a. Cemex S.A.B. de C.V.
         b. Lafarge North America Inc.;
         c. Lehigh Cement Company;
         d. National Cement Company, Inc.
   B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   C. Hydrated Lime: ASTM C207, Type S.
   D. Mortar Aggregate: ASTM C144.
   E. Grout Aggregate: ASTM C404.
   F. Water: Clean and potable.
   G. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

2.03 REINFORCEMENT AND ANCHORAGE
   A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; galvanized.
   B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated. Joint reinforcement shall be hot-dipped galvanized.
C. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.

D. Wall Ties: Corrugated formed sheet metal, 7/8 inch (22 mm) wide by 0.05 inch (1.22 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch (25 mm) and not less than 1 inch (25 mm) of mortar coverage from masonry face. (Does this apply? We have no brick, right?)

E. Partition Top anchors: 0.105-inch- (2.66-mm-) thick metal plate with 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication. (I think this needs to be deleted we show anchorage details).

F. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.04 FLASHINGS
A. Plastic Flashings: Sheet polyolefin laminated to polypropylene; 40 mil (1mm) thick.

B. Flexible Flashing with Elvaloy KEE: Solid-phase plasticizer and flexibilizer added to membrane flashing.

C. Factory-Fabricated Flashing Corners and Ends: Stainless steel.

D. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

2.05 ACCESSORIES
A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Termination Bars: Extruded aluminum; compatible with membrane and adhesives.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXES
A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type S.
   3. Exterior, non-loadbearing masonry: Type S.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm). Grout to be provided by ready-mix supplier.

C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION
A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
3.03 COLD AND HOT WEATHER REQUIREMENTS
   A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.04 COURSING
   A. Establish lines, levels, and coursing indicated. Protect from displacement.
   B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
   C. Concrete Masonry Units:
      1. Bond: Running.
      2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).

3.05 PLACING AND BONDING
   A. Interlock intersections and external corners, except for units laid in stack bond.
   B. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
   C. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
   D. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
   E. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.
   F. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
      1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
      2. Retain subparagraph below unless high-lift grouting is allowed. See Evaluations. MSJC Specification limits grout lifts to 60 inches (1520 mm) unless masonry has cured for at least 4 hours, grout slump is between 10 and 11 inches (254 and 279 mm), and there are no intermediate bond beams between top and bottom of pour height.
      3. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL
   A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602 and as follows:
   B. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
   C. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
   D. Place continuous joint reinforcement in first and second joint below top of walls.
   E. Lap joint reinforcement ends minimum 6 inches (150 mm).
   F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.
   G. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.

3.07 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY
   A. Install horizontal joint reinforcement 8 inches (200 mm) on center.
   B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
C. Place continuous joint reinforcement in first and second joint below top of walls.
D. Lap joint reinforcement ends minimum 6 inches (150 mm).
E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.

3.08 MASONRY FLASHINGS (DO NOT EXTEND FLASHING INTO STRUCTURAL WALLS)

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up at least 8 inches (203 mm), minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.
B. Extend plastic and laminated flashings to within 1/4 inch (6 mm) of exterior face of masonry.
C. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.
D. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
E. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.
F. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
G. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
H. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section “Joint Sealants” for application indicated.
I. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

3.09 LINTELS

A. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Openings to 42 inches (1070 mm): Place two, No. 3 (M9) reinforcing bars 1 inch (25 mm) from bottom web.
   2. Openings from 42 inches (1070 mm) to 78 inches (1980 mm): Place two, No. 5 (M16) reinforcing bars 1 inch (25 mm) from bottom web.
   3. Openings over 78 inches (1980 mm): Reinforce openings as detailed.
   4. Do not splice reinforcing bars.
   5. Support and secure reinforcing bars from displacement. Maintain position within tolerances permitted by ACI 530/530.1. Use ties or stabilizers where applicable. Maintain 3/4" clear around bars.
   6. Place and consolidate grout fill without displacing reinforcing.
   7. Allow masonry lintels to attain specified strength before removing temporary supports.
B. Maintain minimum 8 inch (____ mm) bearing on each side of opening.

3.10 GROUTED COMPONENTS
A. Lap splices minimum 48 bar diameters.
B. Support and secure reinforcing bars from displacement. Maintain position within tolerances permitted by ACI 530/530.1. Use ties or stabilizers where applicable. Maintain 3/4” clear around bars.
C. Place and consolidate grout fill without displacing reinforcing.

3.11 CONTROL AND EXPANSION JOINTS
A. Do not continue horizontal joint reinforcement through control or expansion joints.
B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer’s instructions.
C. Size control joints as indicated on drawings; if not shown, 3/4 inch (19 mm) wide and deep.
D. Form expansion joint as detailed on drawings.

3.12 BUILT-IN WORK
A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
B. Install built-in items plumb, level, and true to line.
C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.
D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES
A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.14 CUTTING AND FITTING
A. Cut and fit for pipes and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

3.15 FIELD QUALITY CONTROL
A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports in accordance with Division 01 requirements. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
B. Inspections: Special inspections according to the "International Building Code." Refer to section 01 4100.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof. Test grout for each day's placement.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. MSJC Code requires verification of compliance of proportions for site-prepared mortar. Test in first paragraph below verifies ratio of aggregate to cementitious materials but does not indicate what cementitious materials are used. Observation of actual mortar mixing procedures as part of inspection program would provide better quality control.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

J. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

3.16 CLEANING

A. Remove excess mortar and mortar droppings.

B. Clean soiled surfaces with cleaning solution.

C. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

D. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

E. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

F. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

G. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

3.18 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
3. Generally retain subparagraph below. If required, increase limit if acid-soil plants are used for foundation plantings.
4. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner’s property.

END OF SECTION
SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Shop fabricated steel items.
   B. Elevator Pit Ladder

1.02 RELATED REQUIREMENTS
   A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
   B. Section 03 4100 - Precast Structural Concrete: Placement of metal fabrication in precast structural concrete.
   C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
   D. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS
   I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.
   J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
   D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL
   A. Steel Sections: ASTM A36/A36M.
   B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
C. Plates: ASTM A283/A283M.
E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION
A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Continuously seal joined members by continuous welds.
D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS
A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).
   2. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
   3. Space rungs 7 inches (175 mm) from wall surface.
B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
C. Clearance Bars: Steel Pipe as detailed, prime paint
D. Lintels: As detailed; prime paint finish.

2.04 SHOP FABRICATED STEEL ITEMS.
A. Elevator Pit Ladder
   2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
   3. Finish: Manufacturer's standard factory applied powder coat finish.
   4. Color: To be selected by CMH Architects, Inc. from manufacturer's standard range.
   5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, integral neoprene gaskets, and rubber coupling.

2.05 FINISHES - STEEL
A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for _______ finish.
B. Prepare surfaces to be primed in accordance with SSPC-SP2.
C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
D. Prime Painting: One coat.
E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft (530 g/sq m) galvanized coating.
F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
2.06 FABRICATION TOLERANCES
   A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
   B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
   C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
   D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
   E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
   A. Clean and strip primed steel items to bare metal where site welding is required.
   B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION
   A. Install items plumb and level, accurately fitted, free from distortion or defects.
   B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
   C. Obtain approval prior to site cutting or making adjustments not scheduled.
   D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
   C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION
SECTION 05 5100 - METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Stairs with concrete treads.
   B. Structural steel stair framing and supports.
   C. Handrails and guards.

1.02 RELATED REQUIREMENTS
   A. Section 03 3000 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.
   B. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.
   C. Section 04 2000 - UNIT MASONRY: Placement of metal fabrications in masonry.
   D. Section 09 9000 - Painting: Paint Finish

1.03 REFERENCE STANDARDS
   F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
   O. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
      1. Include the design engineer's stamp or seal on each sheet of shop drawings.
C. Delegated Design Data: As required by authorities having jurisdiction.
D. Welders' Certificates.
E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Alabama, or personnel under direct supervision of such an engineer.
B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.
C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Structural Design: Provide complete stair and railing assemblies complying with the applicable local code.
   4. Dimensions: As indicated on drawings.
   5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.
B. Risers: Closed.
C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches (38 mm), minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch (1.9 mm) minimum.
   4. Concrete Reinforcement: None.
   5. Concrete Finish: For resilient floor covering.
D. Risers: Same material and thickness as tread pans.
   1. Nosing Depth: Not more than 1-1/2 inch (38 mm) overhang.
   2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch (12 mm) wide.

E. Stringers: Steel Tubes.
   1. Stringer Depth: 12 inches (305 mm). minimum or as required

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel picket railings.

H. Finish: Shop- or factory-prime painted. refer to Section 09 9000 for the required primer.

I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
   1. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.

B. Guards:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.
   2. Infill at Picket Railings: Vertical pickets.
      a. Horizontal Spacing: Maximum 4 inches (100 mm) on center.
      b. Material: Solid steel bar.
      c. Shape: Square.
      d. Size: 1/4 inch (6 mm) square.
      e. Top Mounting: Welded to underside of top rail.
      f. Bottom Mounting: Welded to top surface of stringer.
   3. End and Intermediate Posts: Same material and size as top rails.
      a. Horizontal Spacing: As indicated on drawings.
      b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

E. Concrete Fill: Portland cement Type I, 3000 psi (20 MPa) 28 day strength, 2 to 3 inch (50 to 75 mm) slump.

F. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.05 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.
   2. Number of Coats: One.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
   A. When field welding is required, clean and strip primed steel items to bare metal.
   B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION
   A. Install components plumb and level, accurately fitted, free from distortion or defects.
   B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
   C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
   D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
   E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
   F. Obtain approval prior to site cutting or creating adjustments not scheduled.
   G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

END OF SECTION
SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wall mounted handrails.
   B. Balcony railings and guardrails.

1.02 RELATED REQUIREMENTS
   A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.
   B. Section 04 2000 - UNIT MASONRY: Placement of anchors in masonry.
   C. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
   D. Section 09 9000 - Painting: Paint Finish

1.03 REFERENCE STANDARDS
   C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
   F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS
   A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.
   B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.
   C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.
   D. Allow for expansion and contraction of members and building movement without damage to connections or members.
   E. Dimensions: See drawings for configurations and heights.
      1. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round. Match stair railing in Section 05 5100
      2. Intermediate Rails: 1-1/2 inches (38 mm) diameter, round.
      3. Posts: 1-1/2 inches (38 mm) diameter, round.
F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   3. For anchorage to stud walls, provide backing plates, for bolting anchors.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM
A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.
B. Steel Pipe: ASTM A53/A53M, Grade B Schedule 80, black finish.
C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION
A. Accurately form components to suit specific project conditions and for proper connection to building structure.
B. Fit and shop assemble components in largest practical sizes for delivery to site.
C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
D. Anchor railings securely to structure.
E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.
F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush
countersunk fastenings.

3.04 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
   C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION
SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Rough opening framing for doors, windows, and roof openings.
B. Roofing nailers.
C. Preservative treated wood materials.
D. Fire retardant treated wood materials.
E. Communications and electrical room mounting boards.
F. Concealed wood blocking, nailers, and supports.
G. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.

1.03 REFERENCE STANDARDS
D. PS 1 - Structural Plywood; 2009.
F. SPIB (GR) - Grading Rules; 2014.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials.

1.05 DELIVERY, STORAGE, AND HANDLING
A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir (South), unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Lumber fabricated from old growth timber is not permitted.

C. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.
   1. Where salvaged lumber is used for structural applications, provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc; www.alsc.org.

D. Lumber fabricated from recovered timber (abandoned in transit) is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

   A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

   B. Sizes: Nominal sizes as indicated on drawings, S4S.

   C. Moisture Content: S-dry or MC19.

   D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
      1. Lumber: S4S, No. 2 or Standard Grade.
      2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

   A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

   A. Fasteners and Anchors:
      2. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

   A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
      1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
      2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

   B. Fire Retardant Treatment:
      1. Manufacturers:
         d. Substitutions: See Section 01 6000 - Product Requirements.
      2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. Treat rough carpentry items as indicated.

c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

1. Manufacturers:

   a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   b. Treat lumber exposed to weather.
   c. Treat lumber in contact with roofing, flashing, or waterproofing.
   d. Treat lumber in contact with masonry or concrete.
   e. Treat lumber in other locations as indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

3.06 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION
PART 1 — GENERAL

1.01 SUMMARY

A. The Work of this Section includes, but is not limited to, pre-applied sheet membrane waterproofing that forms an integral bond to poured concrete for the following applications:
   1. Vertical Applications: Membrane applied against soil retention system prior to placement of concrete foundation walls;
   2. Horizontal Applications: Membrane applied on prepared subbase prior to placement of concrete slabs.

B. Related sections include, but are not limited to, the following:
   1. Section 033000 – Cast-In-Place Concrete

1.02 SUBMITTALS

A. Submit manufacturer’s product data, installation instructions and membrane samples for approval.

1.03 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society for Testing and Materials (ASTM):
   D 412 Standard Test Methods for Rubber Properties in Tension
   D 570 Standard Test Method for Water Absorption of Plastics
   D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
   D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel)
   D 3767 Standard Practice for Rubber - Measurements of Dimensions
   D 5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
   E 96 Standard Test Methods for Water Vapor Transmission of Materials
   E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.04 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.
B. Installer: A firm which has at least 3 years experience in work of the type required by this section.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

E. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING
A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

1.06 PROJECT CONDITIONS
A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.07 WARRANTY
A. Sheet Membrane Waterproofing: Provide written five year material warranty issued by the membrane manufacturer upon completion of work.

PART 2 — PRODUCTS
2.01 MATERIALS
A. Pre-applied Integrally Bonded Sheet Waterproofing Membrane: Preprufe® 300R Membrane by Grace Construction Products, a 1.2mm (0.046 in) nominal thickness composite sheet membrane comprising 0.8 mm (0.030 in.) of high density polyethylene film, and layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete. Provide membrane with the following physical properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Test Method</td>
<td>White</td>
</tr>
<tr>
<td>Thickness</td>
<td>ASTM D 3767 Method A</td>
<td>1.2 mm (0.046 in.) nominal</td>
</tr>
<tr>
<td>Lateral Water Migration Resistance</td>
<td>ASTM D 5385 Modified¹</td>
<td>Pass at 71 m (231 ft) of hydrostatic head pressure</td>
</tr>
<tr>
<td>Low Temperature Flexibility</td>
<td>ASTM D 1970</td>
<td>Unaffected at -29°C (-20°F)</td>
</tr>
<tr>
<td>Elongation</td>
<td>ASTM D 412 Modified²</td>
<td>500%</td>
</tr>
</tbody>
</table>

Pre-Applied Sheet Membrane
Waterproofing
<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Standard</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack Cycling at -23°C (-9.4°F), 100 Cycles</td>
<td>ASTM C 836</td>
<td>Unaffected, Pass</td>
</tr>
<tr>
<td>Tensile Strength, film</td>
<td>ASTM D 412</td>
<td>27.6 MPa (4,000 lbs/in.²)</td>
</tr>
<tr>
<td>Peel Adhesion to Concrete</td>
<td>ASTM D 903 Modified³</td>
<td>880 N/m (5.0 lbs/in.)</td>
</tr>
<tr>
<td>Lap Adhesion</td>
<td>ASTM D 1876 Modified⁴</td>
<td>880 N/m (5.0 lbs/in.)</td>
</tr>
<tr>
<td>Resistance to Hydrostatic Head</td>
<td>ASTM D 5385 Modified⁵</td>
<td>71 m (231 ft)</td>
</tr>
<tr>
<td>Puncture Resistance</td>
<td>ASTM E 154</td>
<td>990 N (221 lbs)</td>
</tr>
<tr>
<td>Permeance</td>
<td>ASTM E 96 Method B</td>
<td>0.6 ng/Pa x s x m² (0.01 perms)</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D 570</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Footnotes:
1. Lateral water migration resistance is tested by casting concrete against membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the blind side waterproofing membrane. A hydrostatic head pressure of 71 m (231 ft) of water is the limit of the apparatus.
2. Elongation of membrane is run at a rate of 50 mm (2 in.) per minute.
3. Concrete is cast against the protective coating surface of the membrane and allowed to cure (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 50 mm (2 in.) per minute at room temperature.
4. The test is conducted 15 minutes after the lap is formed as per manufacturer’s instructions and run at a rate of 50 mm (2 in.) per minute.
5. Hydrostatic head tests are performed by casting concrete against the membrane with a lap. Before the concrete sets a 3 mm (0.125 in.) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to a head of 71 m (231 ft) of water which is the limit of the apparatus.


PHYSICAL PROPERTIES FOR GRACE ADCOR™ ES HYDROPHYLIC WATERSTOP:

<table>
<thead>
<tr>
<th>Property</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Green</td>
</tr>
<tr>
<td>Size</td>
<td>1.0 in. x ½ in. x 16 ft. rolls (25.4 mm x 12.7 mm x 4.9 m)</td>
</tr>
<tr>
<td>Hydrostatic Head Resistance</td>
<td>70 m (231 ft)</td>
</tr>
<tr>
<td>Wet - Dry Cycling [25 Cycles @ 231 ft (70 m)]</td>
<td>No Effect</td>
</tr>
<tr>
<td>Adhesion to Concrete using Adcor ES Adhesive</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

D. Preformed Soil Retention Wall Tieback Cover: Preprufe Tieback Cover by Grace Construction Products as a prefabricated detail for soil retention wall tiebacks.

E. Preformed Inside and Outside Corners: Preprufe Preformed Corners by Grace Construction Products as prefabricated inside and outside corners.
F. Tape for covering cut edges, roll ends, penetrations and detailing: Preprufe Tape LT (for temperatures between 25°F (-4°C) and 86°F (+30°C)) and Preprufe Tape HC (for use in Hot Climates, minimum 50°F (10°C))

G. Miscellaneous Materials: accessories specified or acceptable to manufacturer of pre-applied waterproofing membrane.

**PART 3 — EXECUTION**

**3.01 EXECUTION**

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

**3.02 SUBSTRATE PREPARATION**

A. It is essential to create a sound and solid substrate to eliminate movement during the concrete pour. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability.

1. Horizontal Surfaces - The substrate must be free of loose aggregate and sharp protrusions. Avoid curved or rounded substrates. When installing over earth or crushed stone, ensure substrate is well compacted to avoid displacement of substrate due to traffic or concrete pour. The surface does not need to be dry, but standing water must be removed.

2. Vertical Surfaces - Use concrete, plywood, insulation or other approved facing to sheet piling to provide support to the membrane. Board systems such as timber lagging must be close butted to provide support and not more than 0.5 in. (12 mm) out of alignment.

**3.03 INSTALLATION, HORIZONTAL APPLICATIONS**

A. Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:

1. Place the membrane HDPE film side to the substrate with the clear plastic release liner facing towards the concrete pour. End laps should be staggered to avoid a build-up of layers.

2. Leave the plastic release liner in position until overlap procedure is completed.

3. Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap.

4. Peel back the plastic release liner from between the overlaps as the two layers are bonded together. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller.

5. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear.

**3.04 INSTALLATION, VERTICAL APPLICATIONS**
A. Strictly comply with installation instructions in manufacturer’s published literature, including but not limited to, the following:

1. Mechanically fasten the membrane vertically using fasteners appropriate to the substrate with the clear plastic release liner facing towards the concrete pour. The membrane may be installed in any convenient length.
2. Fastening through the selvedge using a small and low profile head fastener so that the membrane lays flat and allows firmly rolled overlaps.
3. Immediately remove the plastic release liner.
4. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap.
5. Roll firmly to ensure a watertight seal.
6. Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary.
7. Allow to dry and apply Preprufe Tape LT (or HC in hot climates) centered over the lap edges and roll firmly.
8. Immediately remove printed plastic release liner from the tape.

3.05 WATERSTOP INSTALLATION

A. Strictly comply with installation instructions in manufacturer’s published literature, including but not limited to, the following:

1. Secure Adcor ES using masonry nails 1½ in. - 2 in. (40 mm – 50 mm) long with a washer ¾ in. (20 mm) in diameter. Hilti EM6-20-12 FP8 shot fired fixings with ¼ in. (6 mm) nuts and ¾ in. (20 mm) diameter washers may also be used. Fixings should be spaced at a maximum of 12 in. (300 mm) centers with a minimum spacing that ensures proper contact to substrate.
2. On irregular concrete faces, or on vertical surfaces, apply a ½ in. (12 mm) bead of Adcor ES Adhesive as bedding for Adcor ES.
3. Adcor ES joints should overlap a minimum of 4 in. (100 mm), ensuring full contact between jointed pieces.

3.06 PROTECTION

A. Protect membrane in accordance with manufacturer’s recommendations until placement of concrete. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer’s recommendations.

END OF SECTION
PART 1 — GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 SUMMARY

A. The work of this section includes, but is not limited to, the following:

1. Fluid applied waterproofing system
2. Composite membrane
3. Prefabricated drainage composite

B. System Description: The fluid applied composite sheet membrane waterproofing system shall consist of the following:

1. Fluid Applied Membrane: A minimum thickness as per section 3.03 of a two-component self-curing synthetic rubber waterproofing membrane
2. Composite Membrane: 3-layer reinforced composite membrane fully embedded into fluid-applied membrane with end laps and sidelaps taped with self-adhering waterproofing membrane.
3. Accessories and Materials for complete waterproofing application

C. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1. Section 033000 – Cast-In-Place Concrete

1.03 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.

B. American Society for Testing and Materials (ASTM)

C 898 Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Separate Wearing Course
D 412 Standard Test Methods for Rubber Properties in Tension
D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
D 1644 Test Methods for Nonvolatile Content of Varnishes
D 3767 Standard Practice for Rubber - Measurements of Dimensions
D 1709  Standard Test Methods for Impact Resistance of Plastic Films by the Free Falling Dart Method
D 882   Standard Test Method for Tensile Properties of Thin Plastic Sheeting

1.04 SUBMITTALS
A. Product Data: Submit manufacturer’s product data, installation instructions, use limitations and recommendations.
B. Shop drawings showing locations and extent of waterproofing including details for terminations and flashings, projections, penetrations, drains and treatment of substrate joints and cracks.
C. Written documentation demonstrating installers qualifications under the "Quality Assurance" article including reference projects of a similar scope.
D. Samples: Submit representative samples of the following for approval:
   1. Fluid applied membrane
   2. Composite Membrane
   3. Prefabricated drainage composite
E. Warranty: Submit a sample warranty identifying the terms and conditions stated in Section 1.7.

1.05 QUALITY ASSURANCE
A. Manufacturer: Waterproofing systems shall be manufactured and marketed by a firm with a minimum of 20 years’ experience in the production and sales of waterproofing. The fluid applied composite sheet membrane waterproofing system must be supplied by single manufacturer. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
B. Installer: The installer shall demonstrate qualifications to perform the work of this Section by submitting the following:
   1. Certification or written license from the Waterproofing Manufacturer that the Installer is a trained applicator.
   2. List of at least three (3) projects contracted within the past five (5) years of similar scope and complexity to this project.
   3. Installer must show evidence of adequate equipment and trained field personnel to successfully complete the project in a timely manner.
   4. Installer’s credentials must be approved by both the Architect and the Waterproofing Materials Manufacturer.
C. Materials: Fluid applied composite sheet membrane waterproofing system shall be by single source manufacturer and shall consist of fluid applied waterproofing material, a two part synthetic rubber based system free of isocyanates and bitumen and a composite sheet, a three-layer co-extruded biaxially oriented HDPE integrally bonded to a non-woven geotextile. For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.
C. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of surface preparation, minimum curing period, installation procedures, special details and flashings, inspection, testing, protection and repair procedures.

D. Inspection and Testing: All areas shall be water tested following application and be inspected an individual trained and approved by the waterproofing systems manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in the original, unopened containers with seals unbroken, labeled with the manufacturer’s name, product brand name and type, date of manufacture and directions for storage and use.

B. Store and handle materials in strict compliance with manufacturer’s instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Do not double-stack pallets of waterproofing on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
2. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
3. Protect waterproofing materials from freezing.
4. Store composite membrane. The composite membrane should be stored off the ground and not stacked more than 12 rolls high. Provide cover for material to protect top and sides.

C. Sequence deliveries to avoid delays, but minimize on-site storage.

1.07 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive membrane waterproofing.

C. Do not allow waste products (i.e. petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, acids, etc.) to come into contact with the waterproofing membrane. Any exposure to foreign materials or chemical discharges must be presented to the Membrane Manufacturer to determine the impact on the waterproofing assembly performance.

D. Horizontal Application - Concrete Deck Surface condition:

1. A minimum slope to drain of 11 mm/m (1/8 in./ft) shall be used on all concrete decks. This is best achieved with a monolithic structural slab and not with a separate concrete fill layer.
2. Ensure no excessive deflection or movement of the deck or other structural problems.
3. The deck shall provide for support of the maximum anticipated dead and environmental loads and for expansion and contraction suitable for the roof system structure.
4. All projections, penetrations and openings in the deck should be completed before the waterproofing application begins.
5. Joints in pre-cast/pre-stressed concrete decks are to be grouted so that the top surface is level and smooth before membrane application.

E. Deck/Wall Preparation: refer to Section 3.2 Substrate Preparation

F. General contractor shall assure adequate protection and ventilation during the application of the Waterproofing assembly.

1.08 WARRANTY

A. Fluid-Applied Sheet and Waterproofing System: Upon completion of the fluid-applied and sheet waterproofing system, the contractor must submit a written warranty for the waterproofing materials signed by the Waterproofing Manufacturer.

B. Warranties available from the manufacturer. Please see manufacturer specific written warranty documents for specifics (Choose one):

Material Warranty:
- Manufacturer’s standard 5-year material warranty
- Manufacturer’s standard 10-year material warranty

Watertightness Warranty:
- Manufacturer’s standard 10-year watertightness warranty
- Manufacturer’s standard 15-year watertightness warranty.

PART 2 — PRODUCTS

2.01 GENERAL

All waterproofing materials shall be manufactured and supplied by:

Grace Construction Products, 62 Whittemore Avenue, Cambridge, MA.

2.02 MATERIALS

A. Fluid Applied Waterproofing Membranes: Procor® 75 fluid applied membrane by Grace Construction Products; a two part, self-curing, synthetic rubber based material. Procor® fluid applied membranes meet or exceed the performance requirements of ASTM C 836 and other ASTM standards as shown in the following table.

B. Waterproofing Membrane Physical Properties:

PHYSICAL PROPERTIES FOR PROCOR® FLUID APPLIED MEMBRANES:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Terra Cotta</td>
<td></td>
</tr>
<tr>
<td>Minimum Cured Film Thickness</td>
<td>ASTM D 3767 Method A</td>
<td>3.0 mm (120 mils)</td>
</tr>
<tr>
<td>Solids Content</td>
<td>ASTM D 1644</td>
<td>100%</td>
</tr>
<tr>
<td>Flexibility, 180° bend over 25 mm (1 in.) mandrel at 32°C (-25°F)</td>
<td>ASTM D 1970</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Elongation</td>
<td>ASTM D 412</td>
<td>500% minimum</td>
</tr>
<tr>
<td>Peel Adhesion to Concrete</td>
<td>ASTM D 903 Modified1</td>
<td>880 N/m (5 lbs/in.)</td>
</tr>
</tbody>
</table>
Low temperature flexibility and crack bridging - 3.2mm (1/8 in.) cracked cycled at -26°C (-15°F) | ASTM C 836 | Pass
---|---|---
Extensibility over 6.4 mm (1/4 in.) crack after heat aging | ASTM C 836 | Pass
Puncture Resistance | ASTM D 4833 | 170 N (38 lbs)

Footnote:
1. Procor waterproofing membrane is applied to concrete and allowed to cure. Peel adhesion of the membrane is measured at a rate of 50 mm (2 in.) per minute with a peel angle of 90° at room temperature.

C. Composite Sheet Membrane: Procor Composite Membrane as supplied by Grace Construction Products, a 16-mil, cross-laminated, high-density polyethylene membrane.

D. Composite Sheet Membrane Physical Properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td>Terra Cotta</td>
</tr>
<tr>
<td>Thickness</td>
<td></td>
<td>0.9 mm (36 mils)</td>
</tr>
<tr>
<td>Puncture Resistance</td>
<td>ASTM D 1709</td>
<td>3912 grams</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D 882</td>
<td>136 lbs/in</td>
</tr>
<tr>
<td>Vapor Transmission</td>
<td>ASTM E 96</td>
<td>0.030</td>
</tr>
</tbody>
</table>

E. Prefabricated Drainage Composite (Edit to project requirements): Hydroduct 220 Drainage Composite by Grace Construction Products for all vertical surfaces. Drainage composite shall be designed to promote positive drainage while serving as a protection course.

F. Concrete Sealer (optional depending on substrate conditions): Procor Concrete Sealer by Grace Construction Products for concrete surfaces likely to produce outgassing during drying process.

G. Composite Sheet Lap Sealing: Bituthene Low Temperature Membrane by Grace Construction Products, a 60 mil self-adhering waterproofing comprising 56 mils of rubberized asphalt integrally bonded to a 4 mil high density cross-laminated polyethylene film.

H. Waterstop: Adcor™ ES hydrophilic non-bentonite waterstop by Grace Construction Products for non-moving concrete construction joints

I. Insulation (Edit to project requirements): An extruded polystyrene rigid board insulation meeting the following requirements:
   1. Minimum compressive strength, ASTM D1621, 40 or 60 psi (variance by product type).
   2. Maximum water absorption by volume per ASTM C272, 0.1%
   3. Insulation shall have an R-value of 5.0 F.ft2h/Btu/in. (0.88 K.m2/W) of thickness when tested at 75°F (23.9°C) mean temperature in accordance with ASTM C518.
   4. Product shall be free of CFCs.

J. Miscellaneous Materials: Tape and other accessories specified or acceptable to manufacturer of fluid applied waterproofing membrane.
PART 3 — EXECUTION

3.01 EXAMINATION
A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION OF SUBSTRATES
A. Refer to manufacturer’s literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid applied waterproofing.

B. Tie-holes and “bugholes” larger than 13 mm (1/2”) in diameter or deeper than 3 mm (1/8”), or both, should be either pretreated with Procor or repaired with a lean concrete mix or with a lean concrete mix or grout. See ASTM D 5295, Preparation of Concrete Surfaces for Adhered Membrane Waterproofing Systems, for further details on substrate preparation.

C. Cracked, pitted, honeycombed or heavily bugholed surfaces can be filled by spraying from close in (10” to 12”) but high material usage with result. Under these circumstances it may be more efficient to fill the surface with a parge coat of lean mortar mix before application of the Procor. It is also acceptable to fill in gaps with a compatible sealant or caulk.

D. Cast-In-Place Concrete Substrates:
   1. For horizontal applications, poured in-place concrete must be cast with a minimum slope to drain of 11 mm/m (1/8 in./ft) and must be monolithic, smooth, and free of unapproved curing compounds, form release agents and other surface contaminants.
   2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
   3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
   4. Remove scaling to sound, unaffected concrete and repair exposed area.
   5. Grind irregular construction joints to suitable flush surface.

E. Pre-cast Concrete Decks: All pre-cast units shall be mechanically fixed to minimize the potential for differential movement and all joints shall be grouted.

F. Substrate Cleaning:
   a) Thoroughly sweep the substrate that is to receive the waterproofing membrane.
   b) Substrate must also be blown using oil free air to remove any remaining loose debris.
   c) A final check to determine if the substrate is sufficiently clean is to apply a test patch of membrane and check its adhesion.

3.03 INSTALLATION
A. Refer to manufacturer’s literature for recommendations on installation, including but not limited to, the following:
   1. Vertical Application Fluid Applied Membrane (Material Warranty Only):
a) Detailing: Apply a minimum thickness of 1.5 mm (60 mils) over all detail areas (including inside corners, outside corners, pipe penetrations, cracks, construction joints, etc) prior to application of the field of the membrane.

b) Apply a minimum thickness of 1.5 mm (60 mils) over all vertical areas to be waterproofed and lapping a minimum of 100 mm (4 in.) onto pre-treated detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

2. Vertical Application Fluid Applied Membrane (Watertightness Warranty)

a) Detailing: Apply a minimum thickness of 1.5 mm (60 mils) over all detail areas (including inside corners, outside corners, pipe penetrations, cracks, construction joints, etc) prior to application of the field of the membrane.

b) Apply a minimum thickness of 2.3 mm (90 mils) over all vertical areas to be waterproofed and lapping a minimum of 100 mm (4 in.) onto pre-treated detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

3. Horizontal Application Fluid Applied Membrane (Material Warranty Only):

a) Detailing: Apply a minimum thickness of 1.5 mm (60 mils), or as per manufacturer’s drawings and written application instructions, over all detail areas (including inside corners, outside corners, pipe penetrations, cracks, construction joints, etc) prior to application of the field of the membrane.

b) Apply a minimum thickness of 1.5 mm (60 mils) over all horizontal areas to be waterproofed and lapping a minimum of 100 mm (4 in.) onto detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

c) Apply a second coat at a minimum thickness of 0.75 mm (30 mils) over first coat and completely covering all detail areas to give a minimum total thickness of 2.25 mm (90 mils) in the field and 3.75 mm (150 mils) at detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

4. Horizontal Application Fluid Applied Membrane (10 year Watertightness Warranty):

a) Detailing: Apply a minimum thickness of 1.5 mm (60 mils), or as per manufacturer’s drawings and written application instructions, over all detail areas (including inside corners, outside corners, pipe penetrations, cracks, construction joints, etc) prior to application of the field of the membrane.

b) Apply a minimum thickness of 1.5 mm (60 mils) over all horizontal areas to be waterproofed and lapping a minimum of 100 mm (4 in.) onto detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

c) Apply a second coat at a minimum thickness of 1.5 mm (60 mils) over first coat and completely covering all detail areas to give a minimum total thickness of 3.0 mm (120 mils) in the field and 4.5 mm (180 mils) at detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

5. Horizontal Application Fluid Applied Membrane (15 year Watertightness Warranty):

d) Detailing: Apply a minimum thickness of 1.5 mm (60 mils), or as per manufacturer’s drawings and written application instructions, over all detail areas (including inside corners, outside corners, pipe penetrations, cracks, construction joints, etc) prior to application of the field of the membrane.

e) Apply a minimum thickness of 1.5 mm (60 mils) over all horizontal areas to be waterproofed and lapping a minimum of 100 mm (4 in.) onto detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

f) Apply a second coat at a minimum thickness of 1.5 mm (60 mils) over first coat and completely covering all detail areas to give a minimum total thickness of 3.0
mm (120 mils) in the field and 4.5 mm (180 mils) at detail areas. Perform wet film thickness tests as work progresses to confirm thickness.

6. Composite Sheet Membrane Application:
   a) Cut Procor Composite Sheet Membrane into manageable widths and lengths to achieve full horizontal coverage. Apply Procor Composite Sheet Membrane into wet or tacky Procor, geotextile side embedded into Procor. Apply pressure using a hand roller or broom to fully adhere Procor Composite Sheet Membrane for full contact into the Procor.
   b) Join adjacent sheets of Procor Composite Sheet Membrane by “butting” sidelaps.
   c) At sidelaps and endlaps, adhere a 12” wide strip of Bituthene Low Temperature Membrane, using a roller to provide fully contact to Procor Composite Sheet Membrane. Overlap Bituthene strips minimum 2", apply in manner to provide watersheding effect.
   d) Treat all edges of Bituthene Membrane with Liquid Membrane.

3.04 WATER TEST
   A. All areas of the deck must be water tested by means of electronic testing or ponding to a minimum depth of 50mm (2 in.) for a period of 24 hours to confirm the integrity of the membrane.
   B. Allow the membrane to cure for a minimum period of 48 hours before starting water tests.
   C. Before flood testing, be sure the structure will withstand the dead load of the water.
   D. For well-sloped decks, segment the flood test to avoid deep water near drains.
   E. Mark any leaks and repair according to manufacturers repair procedures when the membrane is dry.

3.05 CLEANING AND PROTECTION
   A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work.
   B. A protection course should always be installed as soon as possible after completion of the waterproofing installation and flood testing to protect the membrane from mechanical damage and UV.
   C. Install any protection, drainage and insulation courses according to the manufacturer’s instructions.

END OF SECTION
SECTION 07 5423 - THERMOPLASTIC-POLYOLEFIN ROOFING (TPO)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermoplastic membrane roofing system, including all components specified.
B. Disposal of construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
D. Commencement of work by Contractor shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
B. Section 07 6200 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 for definition of terms related to roofing work not otherwise defined in the section.
B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC-S770.

1.04 REFERENCE STANDARDS

K. PS 1 - Structural Plywood; 2009.
1.05 ADMINISTRATIVE REQUIREMENTS
   A. Primary roofer listed as roofer on the General Contractor's sub list provided to the Owner must
      preform this work, sub contracting this work to another entity without the written approval of the
      General Contractor, Owner and Architect is prohibited.

1.06 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data:
      1. Provide membrane manufacturer's printed data sufficient to show that all components of
         roofing system, including insulation and fasteners, comply with the specified requirements
         and with the membrane manufacturer's requirements and recommendations for the
         system type specified; include data for each product used in conjunction with roofing
         membrane.
      2. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show
         exactly how all components will be installed; where instructions allow installation options,
         clearly indicate which option will be used.
   C. Shop Drawings: Provide:
      1. The roof membrane manufacturer's standard details customized for this project for all
         relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion
         joints, penetrations, and drains.
      2. For tapered insulation, provide project-specific layout and dimensions for each board.
   D. Specimen Warranty: Submit prior to starting work.
   E. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the
      specified qualifications.
   F. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN)
      has been accepted and approved by the manufacturer.
   G. Executed Warranty.

1.07 QUALITY ASSURANCE
   A. Installer Qualifications: Roofing installer shall have the following:
      2. Current approval, license, or authorization as applicator by the manufacturer.
      3. Fully staffed office within 150 miles of the job site.
      4. At least five years experience in installing specified system.

1.08 DELIVERY, STORAGE AND HANDLING
   A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and
      labels intact and legible.
   B. Store materials clear of ground and moisture with weather protective covering.
   C. Keep combustible materials away from ignition sources.

1.09 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Comply with all warranty procedures required by manufacturer, including notifications,
      scheduling, and inspections.
   C. Warranty: Firestone Limited Warranty covering membrane, roof insulation, and other indicated
      components of the system, for the term indicated.
      1. Limit of Liability: No dollar limitation.
      2. Scope of Coverage: Repair leaks in the roofing system caused by:
         a. Ordinary wear and tear of the elements.
         b. Manufacturing defect in Firestone brand materials.
         c. Defective workmanship used to install these materials.
d. Damage due to winds up to 72 mph (116 km/h).

3. Not Covered:
   a. Damage due to winds in excess of 72 mph (116 km/h).
   b. Damage due hurricanes or tornadoes.
   c. Hail.
   d. Intentional damage.
   e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

D. Insulation Warranty: Separate Firestone ISO 95+ Insulation Warranty with warranty term coinciding with Red Shield Warranty.
   1. Limit of Liability: No dollar limitation
   2. Scope of Coverage: Provide replacement for insulation that warps, bows, or is on the point of causing a roof leak as a result of manufacturing defect.

E. Metal Roof Edging: Firestone full-system warranty for roof edge system, covering blow-off from winds up to 150 mph (240 km/h).

F. Metal Roof Edging with Exposed Decorative Fascia: Provide 20 year warranty for painted finish covering color fade, chalk, and film integrity.

PART 2 PRODUCTS

2.01 MANUFACTURERS

   1. Roofing systems by other manufacturers are not acceptable.

B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.
   1. Insulation Boards by other manufacturers

C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
   1. Metal roof edging products by other manufacturers are not acceptable.
   2. Field- or shop-fabricated metal roof edgings and copings are not acceptable.

D. Substitutions: See Section 01 6000 - Product Requirements.
   1. Submit evidence that the proposed substitution complies with the specified requirements.
   2. Any substitutions must be approved in writing by the Architect and the Owner prior to including them in project budgets, contracts, or work.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic polyolefin (TPO) single-ply membrane.
   1. Membrane Attachment: Fully adhered.
   2. Warranty: Full system warranty; Firestone 15 year Red Shield Limited Warranty covering membrane, roof insulation, membrane accessories, and metal edging and coping.
   3. Comply with applicable local building code requirements.

B. Roofing System Components: Listed in order from the top of the roof down:
   1. Membrane: Thickness as specified.
   2. Base Sheet Over Insulation: Cold adhesive attached.
   3. Insulation:
      a. Tapered: Slope as indicated; provide minimum R-value (RSI-value) at thinnest point; place tapered layer on bottom.
      b. Total R-value of 6 (RSI-value of 1.06), minimum.
      c. Top Layer: Polyisocyanurate foam board, non-composite; cold adhesive attached.
      d. Intermediate Layer(s), If Any: Polyisocyanurate foam board, non-composite; cold adhesive attached.
      e. Bottom Layer: Polyisocyanurate foam board, non-composite; cold adhesive attached.
      f. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.
2.03 MEMBRANE MATERIALS

A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D6878/D6878M, with polyester weft inserted reinforcement and the following additional characteristics:
1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch (0.61 mm) plus/minus 10 percent.
2. Puncture Resistance: 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.
3. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C1549.

B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches (457 mm) wide.

D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent.
2. Tensile Strength: 1550 psi (10.7 MPa), minimum, when tested in accordance with ASTM D638 after heat aging.
3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D638 after heat aging.
4. Tearing Strength: 12 lbf (53 N), minimum, when tested in accordance with ASTM D1004 after heat aging.

E. Tape Flashing: 5-1/2 inch (140 mm) nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch (1.6 mm) nominal; TPO QuickSeam Flashing by Firestone.

F. Bonding Adhesive: Neoprene and SBR rubber blend, formulated for compatibility with the membrane other substrate materials, including masonry, wood, and insulation facings; UltraPly Bonding Adhesive by Firestone.

G. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.

H. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

I. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.

J. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant by Firestone.

K. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant by Firestone.

L. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing by Firestone.

2.04 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C1289 Type II Class 1, with the following additional characteristics:
1. Thickness: As indicated elsewhere.
2. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
   a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
3. R-value (RSI-value) (LTTR):
   a. 1.0 inch (25 mm) Thickness: 6.0 (1.06), minimum.
   b. 1.5 inch (38 mm) Thickness: 9.0 (1.58), minimum.
   c. 2.0 inch (51 mm) Thickness: 12.1 (2.13), minimum.
   d. 3.0 inch (76 mm) Thickness: 18.5 (3.26), minimum.
   e. 4.0 inch (102 mm) Thickness: 25.0 (4.40), minimum.
4. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C1289.
5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
6. Recycled Content: 19 percent post-consumer and 15 percent pre-consumer (post-industrial), average.
   B. Adhesive for Insulation Attachment: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesives furnished by roof membrane manufacturer.

2.05 METAL ACCESSORIES
   A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailing.
   1. Wind Performance:
      a. Membrane Pull-Off Resistance: 100 lbs/ft (1460 N/m), minimum, when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-1.
      c. Provide product listed in FM (AG) with at least FM 1-270 rating.
   2. Fascia Face Height: 6-1/2 inches (165 mm) or as indicated on drawings.
   3. Edge Member Height Above Nailer: 1-1/4 inches (31 mm).
   4. Fascia Material and Finish: 0.040 inch (1.0 mm) thick formed aluminum, Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
   5. Length: 144 inches (3650 mm).
   6. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
   7. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
   8. Anchor Bar Cleat: 20 gage, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
   9. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
   10. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch (355 mm) long legs on corner pieces.
   12. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

2.06 ACCESSORY MATERIALS
   A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
PART 3 INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work without approved submittals.

D. Do not start work prior to the Pre-Installation Conference. Work preformed prior to the Pre-Installation conference will be considered not in compliance and will be removed.

E. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

F. Perform work using competent and properly equipped personnel.

G. Provide temporary closures during installation, which ensure that moisture does not damage any completed section of the new roofing system, these closure and the maintenance of them are the sole responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed in a timely manner as required to provide a watertight condition.

H. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).

I. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

J. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

K. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements. The Architect's detail takes precedent over standard
details where there is a conflict, unless the detail is determined to be not warrantable in writing prior to beginning the roof work and a acceptable detail has been agreed upon. A statement that a detail installed is acceptable to the manufacturer does not relieve the installer from meeting the requirements of the contract documents.

E. Verify that wood nailers have been properly installed.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.

D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

E. Wood Nailers: Provide wood nailers at all perimeters and other locations where indicated on the drawings, of total height matching the total thickness of insulation being used.
   1. Install with 1/8 inch gap between each length and at each change of direction.
   2. Mechanically fasten to deck to resist force of 200 lbf per linear foot (35 kN/m).

3.04 INSULATION INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day’s work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).

E. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer’s instructions and recommendations; “walk-in” individual roof insulation boards to obtain maximum adhesive contact.

3.05 SINGLE-PLY MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer’s instructions and details.

D. Install membrane adhered to the substrate, with edge securement as specified.

E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer’s recommended bonding material, application rate, and procedures.

F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
   1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.
   2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.
3.06 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
   1. Follow roofing manufacturer's instructions and project specific details.
   2. Remove protective plastic surface film immediately before installation.
   3. Install water block sealant under the membrane anchorage leg.
   4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
   5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
   6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
   7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
   1. Use the longest practical flashing pieces.
   2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
   3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
   4. Provide termination directly to the vertical substrate as shown on roof drawings.

E. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
   1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
   2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1 inch (25 mm) clearance from penetration, sloped to shed water.
   3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
   4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.
   5. High Temperature Surfaces: Where the in-service temperature is, or is expected to be, in excess of 180 degrees F (82 degrees C), protect the elastomeric components from direct contact with the hot surfaces using an intermediate insulated sleeve as flashing substrate as recommended by membrane manufacturer.

3.07 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide an intermediate and final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

B. A copy of the Technical Representative's report should be provided to the Architect as proof of compliance with this requirement. It is the roofer's responsibility to schedule these inspections.
and to insure copies of the reports are provided to the Architect in a timely manner. A copy of these reports shall also be included in the closeout documents.

C. Perform all corrections necessary for issuance of warranty.

3.08 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.09 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION
SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
   B. Sealants for joints within sheet metal fabrications.
   C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS
   A. Section 04 2000 - UNIT MASONRY: Metal flashings embedded in masonry.
   B. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.
   C. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS
   A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE
   A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
   B. Maintain one copy of each document on site.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
   B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS
   A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) (0.81 mm) thick; plain finish shop pre-coated with modified silicone coating.
2. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
3. Color: As selected by CMH Architects, Inc. from manufacturer's standard colors.

B. Copper: ASTM B370, cold rolled 16 oz/sq ft (24 gage) (0.0216 inch) (0.55 mm) thick; natural finish.

2.02 ACCESSORIES
A. Fasteners: Stainless steel, with soft neoprene washers.
B. Primer: Zinc chromate type.
C. Protective Backing Paint: Zinc molybdate alkyd.
D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
E. Sealant to be Exposed in Completed Work: 1; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
F. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION
A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Form pieces in longest possible lengths.
C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION
A. Downspouts: Rectangular profile.
B. Conductor Heads: As shown on documents.
C. Scuppers: As shown on documents.
D. Gutters and Downspouts: Size indicated.
E. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Downspout Supports: Brackets.
F. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.
G. Seal metal joints.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION
A. Install starter and edge strips, and cleats before starting installation.
B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Secure gutters and downspouts in place with concealed fasteners.

E. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.

F. Set splash pads under downspouts, and set in place with ________.

END OF SECTION
SECTION 07 9113 - EXTERIOR EXPANSION AND SEISMIC JOINT SYSTEM SPECIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General
      1. Conditions, Supplementary Conditions and Division-1 General Requirements,
      2. apply to the work of this section.

1.02 WORK INCLUDED
   A. The work shall consist of furnishing and installing expansion joint systems in accordance with
      the details shown on the plans and the requirements of the specifications. The joints are
      proprietary designs utilizing an extruded compression seal and a lubricant adhesive. In the
      event of any discrepancy between the contract drawings and the specifications, clarifications
      must be obtained from the Architect prior to proceeding.

1.03 RELATED WORK
   A. Related work which is specified elsewhere.
      1. Division 3 – Section 03300 on Concrete
      2. Division 3 – Section 03450 on Architectural Precast Concrete
      3. Division 7 – Section 07620 on Sheet Metal Flashings and Trim
      4. Division 7 – Section 07900 on Waterproofing, Sealants and Caulking

1.04 REFERENCES
   A. Publications listed herein are part of this specification to the extent referenced. The criteria
      established in the specifications shall take precedence over the standards reference herein.
         a. ASTM D4070, Standard Specification for Adhesive Lubricant for
            1) Installation of Preformed Elastomeric Bridge Compression Seals in Concrete
            Structures

1.05 SUBMITTALS
   A. Shop Drawings and Product Data – Submit typical expansion joint cross-sections indicating
      pertinent dimensioning, general construction, joint dimensioning and product data information.
      Drawings will also show transition and installation. Drawings will also show transition and
      installation details.
   B. Samples – Submit one (1) sample piece at least 6” long, of each type required, to the Project
      Architect/Engineer for approval.

1.06 SYSTEM DESCRIPTION
   A. DuraFlexTM “NW” Series – No Wing Seal System as manufactured by
      1. Balco, Inc.
      2. The joint seal shall be a watertight deck expansion control system that is capable of
         accommodating multi-directional movement.
      3. The system shall consist of an extruded elastomeric compression seal that is secured to
         the deck using a proprietary ambient-cured lubricant adhesive.
      4. The elastomeric compression seal shall be sized to accommodate the total range of
         movement as dictated by the specifier for each joint location. The contractor will provide
         evidence utilizing the Manufacturer’s product data that the seal profile will comply with the
         requirement.

1.07 QUALITY ASSURANCE
   A. Manufacturer: Obtain joint seals through one source from a single
      1. manufacturer.
2. The Manufacturer shall be ISO 9001 Certified.
   a. The manufacturer shall have documented management and control of the processes that influence the quality of its products.
   b. The manufacturer shall have documented management and control of the processes that influence the quality of its customer service.
   c. Manufacturers in the process of obtaining ISO 9001 Certification shall not be considered.
3. The manufacturer shall have a minimum of ten (10) years of experience in the fabrication of expansion joint system assemblies.

B. Installer: The installer shall be acceptable to the system manufacturer.
   1. The installer shall be insured and also licensed, as required, by the local state agency within the project's jurisdiction.
   2. The approved installer shall prepare and submit details of all special conditions to the manufacturer for review and approval prior to installation.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING
   A. Deliver joint seal systems to the jobsite in new, clean, intact, labeled, unopened crates, containers, pallets, reels, or bundles of sufficient size and strength to protect the materials during transit.
   B. Store all components under shelter in a dry, cool location. Store off the ground; protect from freezing, direct sun exposure, weather and construction activities. The adhesive shall be stored at temperatures between 50°F and 80°F.
   C. Until used, all components should be left in the manufacturer's original, unopened labeled crates, containers, pallets, reels or bundles.

1.09 PROJECT CONDITIONS
   A. Joint Opening – The work may proceed only after the Installer has reviewed the joint opening/temperature information, and coordinated that information with the Engineer's design calculations. This will determine the proper size "NW" seal that should be used for each joint location. Note that this size may vary from that called for in the Bid Documents.
   B. Environmental Conditions – Do not proceed with installation of the compression seal under the following conditions:
      1. When ambient and substrate temperature conditions are outside the limits permitted by the Manufacturer.
      2. When the joint substrates are wet.
   C. The expansion joint blockout and opening concrete surfaces must be sandblasted to remove laitance, loosely bonded material and any other contaminant. They shall be free of dust, oil, grease, wax, moisture and frost. The joint interface walls shall be clean.

1.10 WARRANTY
   A. Warranty: The specified products shall be warranted when installed in strict accordance with the manufacturer’s technical specifications, details, installation instructions and general procedures as well as good industry practice in effect for normal traffic usage and suitable applications under specific design movements and loading conditions.
      1. The expansion joint system shall be warranted for a period of one (1) year.
      2. The specified products shall be warranted for a period of five (5) years when installed by a certified installer, factory trained by the manufacturer and certified in the proper installation of the system.
PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURER

A. Furnish and install as noted in the specifications and as indicated on the drawings DuraFlex™ “NW” Series - No Wing Seal System(s) NW-250 as manufactured by:
   1. Balco, Inc., PO Box 17249, 2626 S. Sheridan, Wichita, Kansas 67217
   2. Phone: 800-767-0082 or (316) 945-9328; Fax: (316) 945-0789.

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 system must be submitted and receive approval of the Architect/Engineer before being incorporated into the work. Proposals made subsequently will not be considered. This submission shall be in accordance with information shown in Division 1

2.02 COMPONENTS AND MATERIALS

A. Elastomeric Compression Seal:
   1. Shall be a preformed seal extruded from a flexible, extruded thermoplastic (TPE) compound (Santoprene) exhibiting the physical properties listed in the table below.

B. The Elastomeric Compression Seal shall have the following properties:
   1. Material: Thermoplastic Rubber (Santoprene)
   2. Hardness, Type A durometer, points; ASTM D2240 64 +/- 3
   3. Specific Gravity; ASTM D297 0.97 +/- 2
   4. Tensile strength, min. psi (Mpa); ASTM D412 1000
   5. Ultimate elongation, min, %; ASTM D412 400
   6. Brittle point, oF; ASTM D746 -76
   7. High Temp Recovery (70 hours @ 212°F); % 82

C. The Lubricant Adhesive shall be a one component, polyurethane and hydrocarbon solvent mixture complying with ASTM D4070.

D. Accessories:
   1. Provide other materials required for complete installation of the DuraFlex™ “NW” Series – No Wing Seal System(s) in accordance with the manufacturer’s written installation instructions.

2.03 FABRICATION

A. Ship thermoplastic compression seal in the longest practical continuous length, coiled on Manufacturer’s standard reel or on wooden pallets shrink-wrapped.

B. Heat weld butt splice connections on the jobsite in accordance with the Manufacturer’s written instructions. All butt splice connections shall incorporate welding of the complete seal profile, including heat fusing of all internal and external web configurations.

C. Horizontal transitions shall be factory fabricated with heat-welded splices, such as 90° corners, tees and crosses. The horizontal transitions shall extend a minimum of 2'-0" in each direction from the splice. All horizontal transitions shall incorporate welding of the complete seal profile, including heat fusing of all internal and external web configurations.

D. Ship Lubricant Adhesive in Manufacturer’s approved containers on wooden pallets, shrink-wrapped.

2.04 FINISHES

A. Santoprene compression seal shall be supplied in standard color: black.
PART 3 - EXECUTION

3.01 INSPECTION

A. The joint opening shall be solid, properly formed, properly cured concrete and shall be formed per the manufacturer's instructions, recommendations and details and per the project requirements. Walls shall be plumb and shall be spaced at consistent width across the joint. Any area needing repair shall be repaired utilizing one of the Balco, Inc. recommended concrete repair materials to provide a solid and square joint opening.

B. Clean dirt, stones, standing water and all other contaminants and impurities from the joint opening and sandblast the vertical walls of the joint to expose aggregate to remove laitance and contaminants and to prepare the surfaces for the installation of the joint system.

3.02 EXAMINATION

A. Verify that field measurements and joint dimensions are as shown on shop drawings prior to releasing materials for fabrication by the manufacturer.

B. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions. Installer shall not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.03 INSTALLATION

A. Work shall not proceed under adverse weather conditions or when temperatures are outside the manufacturer's recommended range.

B. Protect all expansion joint system component parts from damage during installation, placement of concrete and thereafter until completion of the structure.

C. Immediately prior to installation, the joint interfaces should be blown out using compressed air.

D. Prepare the installation area in accordance with the manufacturer's recommendations and instructions.

E. Unpackage the compression seal, uncoil it and allow it to relax to relieve any temporary coiling from shipment packaging and storage. Prepare the seal for installation in accordance with the manufacturer's recommendations and instructions.

F. Install the compression seal system in accordance with the manufacturer's recommendations and instructions.

G. Clean up the work area after installation of the system is completed.

3.04 ADJUSTING AND PROTECTION

A. Protect the completed expansion joint work from damage during construction.

1. Heavy construction vehicles shall not be permitted to cross the joint without the specific and written permission of the Engineer.

2. Subsequential damage to the Compression Seal System shall be repaired at the contractor's expense.
SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Nonsag gunnable joint sealants.
B. Self-leveling pourable joint sealants.
C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS
A. Section 07 9513 - Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.
B. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
C. Section 08 8000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
D. Samples for Verification: Where custom sealant color is specified, obtain directions from CMH Architects, Inc. and submit at least two physical samples for verification of color of each required sealant.
E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE
A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver to manufacturer sufficient samples for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

1.06 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective work within a five year period after Date of Substantial Completion.
C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   6. Substitutions: See Section 01 6000 - Product Requirements.
B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS
A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   3. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
d. Joints where installation of sealant is specified in another section.
e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, Type _______, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
2. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant; Type S (single component) or M (multi-component) and p (pourable).

C. Interior Joints: Use non-sag polyurethane sealant, Type _____, unless otherwise indicated.
2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion; Type ______.
3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
4. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant; Type M (multi-component) and p (pourable).

D. Interior Wet Areas: restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.03 NONSAG JOINT SEALANTS

A. Type S (single component) and NS (nonsag) - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
5. Cure Type: Single-component, neutral moisture curing.

B. Type S (single component) and NS (nonsag) - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

C. Type ___ - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

D. Type ___ - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
1. Movement Capability: Plus and minus 35 percent, minimum.

E. Type ___ - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.

F. Type M (multi-component) and p (pourable) - Epoxy Sealant: ASTM C920, Grade NS and P, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 65 to 75, Shore A, when tested in accordance with ASTM C661.
G. Type S (single component) and NS (nonsag) - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: Standard colors matching finished surfaces, Type OP (opaque).
H. Type ___ - Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

2.04 SELF-LEVELING SEALANTS
A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
   2. Color: Gray.
B. Type ___ - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
   2. Color: Gray.
C. Type ___ - Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
   1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.
D. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multi-component, 100 percent solids by weight.
   2. Hardness: Minimum of 85 (Shore A) or 35 (Shore D), when tested in accordance with ASTM D2240 after 7 days.
   3. Joint Width, Minimum: 1/8 inch (3 mm).

2.05 ACCESSORIES
A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.

3.02 PREPARATION
A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION
   A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
   B. Perform installation in accordance with ASTM C1193.
   C. Install bond breaker backing tape where backer rod cannot be used.
   D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
   E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
   F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
   G. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION
SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.
B. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes installation requirements.
1.06 DELIVERY, STORAGE, AND HANDLING
   A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Hollow Metal Doors and Frames:
      6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN CRITERIA
   A. Requirements for Hollow Metal Doors and Frames:
      1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
      2. Accessibility: Comply with ICC A117.1 and ADA Standards.
      3. Finish: Factory primed, for field finishing.
   B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS
   A. Type ___, Exterior Doors: Thermally insulated.
      1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
         a. Level 2 - Heavy-duty.
         b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
         c. Model 1 - Full Flush.
         d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
      2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
      3. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
      5. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
      6. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
      7. Weatherstripping: Refer to Section 08 7100.

2.04 HOLLOW METAL FRAMES
   A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
   B. General:
      1. Comply with the requirements of grade specified for corresponding door.
HOLLOW METAL DOORS AND FRAMES

2.05 ACCESSORIES
A. Grout for Frames: Portland cement grout with maximum 4 inch (102 mm) slump for hand troweling; thinner pumpable grout is prohibited.

2.06 FINISHES
A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions before starting work.

3.02 PREPARATION
A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION
A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

3.04 TOLERANCES
A. Clearances Between Door and Frame: Comply with related requirements of specified door and frame standards or custom guidelines indicated.
B. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION
SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Aluminum-framed storefront, with vision glass.
   B. Aluminum doors and frames.
   C. Weatherstripping.
   D. Door hardware.

1.02 RELATED REQUIREMENTS
   A. Section 05 1200 - Structural Steel Framing: Steel attachment members.
   B. Section 05 5000 - Metal Fabrications: Steel attachment devices.
   C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
   D. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
   E. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS
   A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordinate with installation of other components that comprise the exterior enclosure.
   B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and ________.
   C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
D. Samples: Submit two samples 6x6 inches (____ x ____ mm) in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Handle products of this section in accordance with AAMA CW-10.
   B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Correct defective Work within a five year period after Date of Substantial Completion.
   C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING
   A. Center-Set Style:
   B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
      3. EFCO, a Pella Company; _____: www.efcocorp.com/sle.
   C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BASIS OF DESIGN -- SWINGING DOORS
   A. Medium Stile, Monolithic Glazing:
   B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
      3. EFCO, a Pella Company; _____: www.efcocorp.com/sle.
   C. Substitutions: See Section 01 6000 - Product Requirements.
      1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.03 STOREFRONT
   A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing.
   a. Factory finish all surfaces that will be exposed in completed assemblies.
   b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
   c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
3. Finish Color: As selected by Architect from manufacturer's standard line.
4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Design Wind Loads: Comply with requirements of ASCE 7.
   b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
3. Air Leakage: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.

2.04 COMPONENTS
A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   2. Cross-Section: As indicated on drawings.
B. Glazing: As specified in Section 08 8000.
C. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Top Rail: 3-1/2” inches (____ mm) wide.
   3. Vertical Stiles: 3-12” inches (____ mm) wide.
   4. Bottom Rail: 11” inches (____ mm) wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront.
2.05 MATERIALS
C. Fasteners: Stainless steel.
D. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
E. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch (0.43 mm) minimum thickness.
F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
G. Glazing Accessories: As specified in Section 08 8000.

2.06 FINISHES
A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) system.
B. Color: Custom color to match Architects sample.

2.07 HARDWARE
A. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
B. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
C. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.
D. Hinges: Butt type, swing clear; top and bottom.
   1. Provide on doors as scheduled.
E. Push/Pull Set: Standard configuration push/pull handles.
   1. Provide on doors as scheduled.
F. Closers: Norton 1601 Bf adjustable surface closer wiht back-check and adjustable hold-open.
   1. Provide on doors as scheduled.
G. Locks: Dead latch with thumbturn inside; keyed cylinder outside. Refer to Hardware 08 7100 for cylinder.
   1. Provide on doors as scheduled.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify dimensions, tolerances, and method of attachment with other work.
B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION
A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
I. Set thresholds in bed of sealant and secure.
J. Install hardware using templates provided.
   1. See Section 08 7100 for hardware installation requirements.
K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES
A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 ADJUSTING
A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING
A. Remove protective material from pre-finished aluminum surfaces.

3.06 PROTECTION
A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION
SECTION 08 7100 - DOOR HARDWARE

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Design/Build Hardware for aluminum and hollow metal doors.

1.02  RELATED REQUIREMENTS

A.  Section 08 1113 - Hollow Metal Doors and Frames.
B.  Section 08 4313 - Aluminum-Framed Storefronts:  Hardware for doors in storefront, including:
   1.  Integral weatherstripping.
C.  Section 08 4313 - Aluminum-Framed Storefronts:  Hardware for same except cylinders;
     installation of cylinders.

1.03  REFERENCE STANDARDS

A.  36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and
     Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
C.  BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders;
     2010.
F.  BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems,
     Builders Hardware Manufacturers Association; 2012.
G.  DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors
     and Frames; 2004.

1.04  SUBMITTALS

A.  See Section 01 3000 - Administrative Requirements, for submittal procedures.
B.  Product Data:  Manufacturer's catalog literature for each type of hardware, marked to clearly
     show products to be furnished for this project.
C.  Hardware Schedule:  Detailed listing of each item of hardware to be installed on each door. Use
     door numbering scheme as included in the Contract Documents. Identify electrically operated
     items and include power requirements.
D.  Keying Schedule:  Submit for approval of Owner.
E.  Manufacturer's Installation Instructions:  Indicate special procedures, perimeter conditions
     requiring special attention.
F.  Maintenance Data:  Include data on operating hardware, lubrication requirements, and
     inspection procedures related to preventative maintenance.
G.  Keys:  Deliver with identifying tags to Owner by security shipment direct from hardware supplier.
H.  Warranty:  Submit manufacturer's warranty and ensure that forms have been completed in
     Owner's name and registered with manufacturer.
I.  Maintenance Materials and Tools:  Furnish the following for Owner's use in maintenance of
     project.
   1.  See Section 01 6000 - Product Requirements, for additional provisions.
   2.  Tools:  One set of all special wrenches or tools applicable to each different or special
        hardware component, whether supplied by the hardware component manufacturer or not.
1.05 DELIVERY, STORAGE, AND HANDLING
   A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.06 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Allegion Brands, Ives, LCN, Schlage, Steelcraft, or Von Duprin; ____: www.allegion.com/us.

2.02 GENERAL REQUIREMENTS
   A. Provide door hardware specified, or as required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.
   B. Provide items of a single type of the same model by the same manufacturer.
   C. Provide products that comply with the following:
      1. Applicable provisions of federal, state, and local codes.
   D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in hardware schedule.
   E. Fasteners:
      1. Concrete and Masonry Substrates: Stainless steel machine screws and lead expansion shields.

2.03 LOCKS AND LATCHES
   A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
      1. If no hardware set is indicated for a swinging door provide an office lockset.
      2. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
      3. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.
   B. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
      1. Provide cams and/or tailpieces as required for locking devices required.
   C. Keying: Grand master keyed.
   D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.04 HINGES
   A. Hinges: Provide hinges on every swinging door.
      1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
      2. Provide ball-bearing hinges at all doors having closers.
      3. Provide hinges in the quantities indicated.
      4. Provide non-removable pins on exterior outswinging doors.
      5. Where electrified hardware is mounted in door leaf, provide power transfer hinges.
2.05 MORTISE LOCKSETS
   A. Locking Functions: As defined in BHMA A156.13, and as follows:
      1. Passage: F01.
      2. Entry, Deadbolt: F20, may be locked without key, free egress.
      3. Exit Only: F07 or F31, may have outside trim, may not be left unlocked.
   B. Manufacturers - Mortise Locksets:
      2. DORMA USA, Inc; M9000 Series: www.dorma.com.

2.06 CLOSERS
   A. Manufacturers - Surface Mounted Closers:
      5. LCN, an Allegion brand; _____: www.allegion.com/us.

2.07 STOPS AND HOLDERS
   A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
      1. Provide wall stops, unless otherwise indicated.
      2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
      3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.
   B. Manufacturers - Wall and Floor Stops/holders:

2.08 GASKETING AND THRESHOLDS
   A. Gaskets: Complying with BHMA A156.22.
      1. On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
      2. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
         a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
      3. On each exterior door, provide door bottom sweep, unless otherwise indicated.
   B. Thresholds: Complying with BHMA A156.21.
      1. At each exterior door, provide a threshold unless otherwise indicated.
   C. Manufacturers - Gasketing and Thresholds:
2.09 KEY CONTROLS

A. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
   1. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
   2. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to number of keys to be managed.

2.10 FIRE DEPARTMENT LOCK BOX

A. Manufacturers - Fire Department Lock Box:
   2. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.
B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.
B. Use templates provided by hardware item manufacturer.
C. Do not install surface mounted items until finishes applied to substrate are complete.
D. Mounting heights for hardware from finished floor to center line of hardware item. As indicated in the following list; unless noted otherwise in Door Hardware Sets Schedule or on the drawings.
   1. For steel doors and frames: Comply with DHI (LOCS) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames".
   2. For Steel Doors and Frames: Refer to Section 08 1113.
E. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.04 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.
B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION
SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Glazing units.
   B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS
   A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
   B. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
   C. Certificate: Certify that products of this section meet or exceed specified requirements.
   D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

1.06 FIELD CONDITIONS
   A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
   B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Float Glass Manufacturers:
      4. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES
   A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
3. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

2.03 GLASS MATERIALS
   A. Float Glass: Provide float glass based glazing unless noted otherwise.
      1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
      3. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.04 GLAZING UNITS
   A. Type G-1 - Monolithic Exterior Vision Glazing:
      1. Applications: Exterior glazing unless otherwise indicated.
      2. Glass Type: Annealed float glass.
      3. Tint: Clear.
      4. Thickness: 1/4 inch (6.4 mm), nominal.

2.05 GLAZING COMPOUNDS

2.06 ACCESSORIES

END OF SECTION
SECTION 09 2424 - PORTLAND CEMENT STUCCO

PART 1 GENERAL

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

1.02 SUMMARY
A. Section includes materials and installation of trowel applied air barrier membrane and stucco brown coat over vertical above grade concrete and concrete masonry walls.
B. Related Requirements (add/delete, depending on specific project requirements):
   1. Section 04 22 00: Concrete Unit Masonry
   2. Section 07 60 00: Flashing and Sheet Metal
   3. Section 07 90 00: Joint Protection

1.03 DEFINITIONS
A. Air Barrier Material: A primary element that provides a continuous barrier to the movement of air.
B. Air Barrier Accessory: A transitional component of the air barrier that provides continuity.
C. Air Barrier Auxiliary Material: A transitional component that provides air barrier continuity furnished by a source other than the primary air barrier manufacturer.
D. Air Barrier Assembly: The collection of air barrier materials, accessory and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 REFERENCES
A. Building Codes and Standards
   3. ICC ES AC 11 Acceptance Criteria for Cementitious Exterior Wall Coatings
B. ASTM Standards
   1. Standard Specification for Application of Portland Cement-Based Plaster
   3. E 96-00 Test Method for Water Vapor Transmission of Materials
   5. E 330-14 Test Method for Structural Performance of Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
C. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
   1. 2013 ASHRAE Handbook - Fundamentals
   2. ASHRAE 90.1 2013, Energy Standard for Buildings Except Low-Rise Residential Buildings

1.05 COORDINATION/SCHEDULING
A. Provide minimum 28 day cure of concrete and concrete masonry units before the installation of air barrier and stucco components.
B. Sequence work such that placement of stucco, stucco primers and finish coats closely follow air barrier installation (90 days maximum between coats) to prevent surfaces from being contaminated by atmospheric conditions, dust, dirt, salts, trades, or other sources of surface contamination.
C. Commence the stucco installation after completion of all floor, roof construction and other construction that imposes dead loads on the wall to prevent excessive deflection (and potential cracking) of the stucco.

D. Provide site grading such that stucco terminates above earth grade minimum 4 inches (100 mm) and above finished grade (pavers/sidewalk) minimum 2 inches (51 mm). Provide increased clearance in freeze/thaw climate zones.

E. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air barrier.

F. Install primary air barrier before installing stucco accessories.

G. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

H. Provide sill flashing before windows and doors are installed to direct water beyond the finished exterior wall surface.

I. Install window and door head flashing immediately after windows and doors are installed.

J. Install diverter flashings wherever water can enter the assembly to direct water beyond the finished exterior wall surface.

K. Install sealants, parapet cap flashing and similar flashing at copings and sills to prevent water entry into the wall assembly immediately after installation of stucco and after finish coatings are dry. Do not install sealant against stucco finish coat in dynamic joint conditions.

L. Attach penetrations through stucco into structural support and provide water tight seal at penetrations.

1.06 SUBMITTALS

A. Manufacturer’s specifications, details and product data.

B. Manufacturer’s standard warranty.

C. Samples for approval as directed by architect or owner.

D. Shop drawings: substrate joints, cracks, flashing transitions, penetrations, corners, terminations, and tie-ins with adjoining construction, interfaces with separate materials that form part of the air barrier and stucco wall assembly.

1.07 QUALITY ASSURANCE

A. Manufacturer requirements
   1. Manufacturer of exterior wall air barrier materials for a minimum of 30 years in North America.

B. Contractor requirements
   1. Knowledgeable in the proper use and handling of Sto materials.
   2. Employ skilled mechanics who are experienced and knowledgeable in waterproofing, air barrier, and stucco application, and familiar with the requirements of the specified work.
   3. Provide the proper equipment, manpower and supervision on the job-site to install the air barrier, and stucco assembly in compliance with the project plans & specifications, shop drawings, and Sto’s published specifications and details.

C. Regulatory Compliance
   1. Primary air barrier material:
      a. Comply with allowable air leakage requirements of ASHRAE 90.1 - 2013
      b. Comply with IRC, IBC, and IECC - 2012 or 2015
   2. Stucco brown coat
      a. Comply with ASTM C 926

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer’s name and identification of product.
B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90 degrees F (32 degrees C). Store away from direct sunlight.

C. Protect portland cement-based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location.

D. Protect and store accessory and auxiliary products in accordance with manufacturer’s written instructions.

1.09 PROJECT/SITE CONDITIONS

A. Maintain ambient and surface temperatures above 40 degrees F (4 degrees C) and below 100 degrees F (38 degrees C), during application and drying period, minimum 24 hours after application of materials.

B. Provide supplementary heat for installation in temperatures less than 40 degrees F (4 degrees C) or if surface temperature is likely to fall below 40 degrees F (4 degrees C).

C. Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.10 WARRANTY

A. Provide manufacturer’s standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sto Corp.

B. Obtain primary air barrier, accessory air barrier materials, stucco, stucco primer and finish coat from single source, except stucco brown coat may be any ASTM C 926 compliant material.

2.02 MATERIALS

A. Primary Air Barrier Material: Sto ExtraSeal - single component polymer modified portland cement-based air barrier membrane material.

B. Accessory Materials

1. Rough Opening Protection
   a. StoGuard RapidSeal: one component rapid drying gun-applied rough opening protection for concrete and CMU walls. Also used as a detail component for shingle lap transition at flashing.

2. Transition Membranes
   a. StoGuard Transition Membrane: flexible air barrier membrane for continuity at transitions - sheathing to foundation, dissimilar materials (CMU to frame wall), wall to balcony floor slab or ceiling, flashing shingle lap transitions, floor line deflection joints, masonry control joints, and through wall joints in masonry or frame construction.
   b. StoGuard RapidFill: one component gun-applied air and moisture barrier membrane material for continuity at static transitions such as: flashing shingle laps, wall to balcony floor slab or ceiling, and through wall penetrations such as pipes, electrical boxes, and scupper penetrations.

C. Auxiliary Materials

1. Wet sealant: Dow Corning 790, 791, and 795 sealants
2. Pre-cured sealant tape: Dow 123
3. Spray foam:
   a. Sto TurboStick Adhesive
   b. Dow Great Stuff for Gaps and Cracks

D. Patching and Leveling Material for Prepared Concrete and Masonry

1. Sto ExtraSeal: polymer modified cement-based patch and leveling material for applications up to 3/8 inch in (10 mm) in depth.

E. Stucco Brown Coat (select one)
1. 102 StoPowerwall Stucco Pre-Blended: fiber reinforced one coat portland cement stucco pre-blended with graded sand, and in compliance with ICC AC 11. See ICC ESR 2323.

F. Stucco Crack Defense
1. Sto Mesh with any Sto Base Coat Product: nominal 4.5 oz/ yd2 (153 g/m2) glass fiber reinforcing mesh with alkaline resistant coating for compatibility with Sto materials for embedment in Sto base coats (refer to base coat product bulletins)

G. Stucco Primers
1. StoPrime - acrylic based tinted primer for fully cured (minimum 28 day old or pH less than 10) stucco surfaces.

H. Stucco Finish
1. Any Sto exterior decorative and protective textured finish as selected and approved by design professional or owner on basis of job site installed mock-ups.

2.03 PERFORMANCE REQUIREMENTS (AIR BARRIER)
A. Water Penetration: ASTM E 514, no water penetration through concrete masonry after 4-hour spray period
B. Adhesion: ASTM D 4541, > 50 psi (345 kPA) on prepared CMU substrates
C. Shear bond strength: Lab Method, > 50 psi (345 kPA) on prepared CMU substrates
D. Water vapor permeance: ASTM E 96 Method B, minimum 5 perms (286 ng/Pa·s·m2)
E. Air permeance: ASTM E 2178, < 0.004 cfm/ft2 (0.02 L/s·m2) air leakage at 1.57 psf (75 Pa)
F. Field adhesion testing: ASTM D 4541, strength requirements as dictated by design professional based on exposure conditions such as building height, orientation, climate, and building design
G. Surface burning: ASTM E 84, < 25 flame spread and < 450 smoke developed
H. Building envelope air leakage: ASTM E 779 or 1827, < 0.4 cfm/ft2 (2.0 L/s·m2)
I. Volatile Organic Compounds: SCAQMD Rule 1113, primary air barrier material, < 50 g/L

2.04 DESIGN CRITERIA
A. Structural (Wind and Axial Loads)
1. Design for maximum allowable deflection normal to the plane of the wall: L/360
2. Design for wind load in conformance with code requirements.
B. Moisture Control
1. Prevent the accumulation of water in the wall assembly and behind the exterior wall cladding:
   a. Minimize condensation within the assembly.
   b. Drain water directly to the exterior where it is likely to penetrate components in the wall assembly (windows and doors, for example).
   c. Provide corrosion resistant flashing to direct water to the exterior in accordance with code requirements, including: above window and door heads, beneath window and door sills, at roof/wall intersections, floor lines, decks, intersections of lower walls with higher walls, and at the base of the wall.
   d. Air Leakage Prevention - prevent excess air leakage in the design and detailing of the wall assembly. Provide continuity between air barrier components in the wall assembly.
   e. Vapor Diffusion and Condensation - perform a dew point analysis of the wall assembly to determine the potential for accumulation of moisture in the wall assembly as a result of water vapor diffusion and condensation. Adjust wall assembly components accordingly to minimize the risk of condensation. Avoid the use of vapor retarders on the interior side of the wall in warm, humid climates.
   f. Protect rough openings with StoGuard rough opening treatment extended no further than the stucco termination accessory expanded flange (as Sto ExtraSeal will not adhere to some StoGuard rough opening treatments). Refer to Sto Guide Details.
g. Where casing bead is used back-to-back at expansion joints, back joints with appropriate StoGuard Transition Membrane. Refer to Sto Guide Details.

h. Seal accessory butt joints with sealant.

C. Air Barrier Continuity: provide continuous air barrier assembly of compatible air barrier components.

D. Substrates
   1. Provide surface plane tolerance not to exceed ¼ inch in 10 feet (6 mm in 3.0 m).
   2. Remove form ties, trim projecting concrete and fill honeycombs or other surface defects with appropriate patch or levelling material.
   3. Concrete - provide for removal of form oil, curing compounds, efflorescence, coatings, salts, or other surface contamination, laitance or other surface conditions that could interfere with adhesion. Provide an absorbent surface, slightly scarified or with surface roughness, or both (refer to Section 3.2A1).
   4. Concrete Masonry - provide open texture concrete masonry units with flush joints, free of efflorescence, coatings, salts, or other surface contamination, weak surfaces or other surface conditions that could interfere with adhesion (refer to Section 3.2B1).
   5. Do not install air barrier, stucco, primers or finishes over efflorescence, laitance or weak surface conditions, painted, coated, salt-contaminated, non-absorbent, smooth, or any concrete or CMU substrate where adhesion is in question, or when total stucco thickness (including finish coat) will exceed 5/8 inch (16 mm). Use appropriate metal plaster base in these cases.

E. Mechanical Ventilation: maintain pressurization and indoor humidity levels in accordance with recommendations of ASHRAE (see 2013 ASHRAE Handbook - Fundamentals).

PART 3 EXECUTION

3.01 EXAMINATION
   A. Inspect concrete and concrete masonry surfaces for:
      1. Contamination - algae, dirt, dust, efflorescence, form oil, fungus, grease, mildew or other foreign substances.
      2. Surface deficiencies - weak, friable, chalkiness, laitance, bugholes, honeycombs, and spalls.
      3. Cracks - measure crack width and record location of cracks.
      4. Damage or deterioration.
      5. Moisture damage - record any areas of moisture damage or excess moisture.
   B. Report deviations from the requirements of project specifications or other conditions that might adversely affect the air barrier installation. Do not start work until deviations are corrected.

3.02 SURFACE PREPARATION
   A. Concrete Masonry Units
      1. Remove projecting joint mortar so it is even with the plane of the wall. Remove surface contaminants such as efflorescence, existing paint or coatings, or any other surface contamination by chemical or mechanical means. Pre-moisten the surface with water just prior to placement of air barrier. Verify adhesion with load tests after stucco/air barrier assembly has fully cured (28 days) on mock-up wall, and throughout the project as directed in 1.9, Testing.
   B. Where bond inhibiting material cannot be removed, where concrete or masonry surface irregularities are such that more than 5/8 inch (16 mm) of stucco (including Sto ExtraSeal skim coat and scratch coat, stucco brown coat, and stucco finish) must be applied, or where the surface is too smooth, dense, or non-absorbent to receive the air barrier or stucco components, install furred or self-furred lath as specified by the design professional. Verify adequacy of lath attachment with respect to design wind pressures. Do not install stucco over unprepared substrates or any substrate where adhesion is in question. (Note: where metal lath is used Sto
Flexyl or Sto Watertight Coat may be installed over the stucco brown coat as an air/moisture barrier with proper integration of other air barrier materials).

3.03 INSTALLATION

A. Coordinate work with other trades to ensure air barrier continuity with connections at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.

B. Install materials only when surface and ambient temperature are minimum 40 degrees F (4 degrees C) and rising during application and drying period and below 100 degrees F (38 degrees C). Install air barrier material to dry or damp surfaces (no standing or glistening water).

C. Rough Opening Protection:
   1. Install StoGuard RapidSeal over wood buck and lap onto Sto ExtraSeal minimum 2 inches (51 mm). Do not install Sto ExtraSeal over StoGuard RapidSeal. Limit extension of StoGuard RapidSeal to limit of expanded flange accessories. Refer to Sto Guide Detail 65c.25.

D. Skim Coat
   1. Concrete - install one coat of Sto ExtraSeal by spray or trowel in a uniform, continuous application at 1/8 inch (3 mm) thick. "Knock down" spray applications with a trowel. Do not install over working or moving joints or joint sealants.
   2. Concrete Masonry - install one liberal coat of Sto ExtraSeal in a uniform, continuous application by spray or trowel at 1/8 inch (3 mm) thick. "Knock down" spray applications with a trowel. Surface must be free of voids and pinholes when dry. Final application must not show CMU surface texture or joints. Do not install over working or moving joints or joint sealants.

E. Transitions
   1. Install air barrier accessory material or auxiliary material at transition areas: foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line. Refer to Sto Guide Details 65c.xx. Limit extension of transition materials to limit of expanded flange accessories at stucco terminations.

F. Stucco Accessories
   1. Install stucco accessories - casing beads, expansion and control joints - over air barrier with appropriate fasteners into supporting construction as required by ASTM C 926.

G. Scratch Coat
   1. Scratch coat: apply an approximate 3/8 inch (9 mm) scratch coat of Sto ExtraSeal by spray or trowel any time after the skim coat application is dry. Scratch the surface horizontally with a stucco rake tool. Moist cure the scratch coat during hot or extremely dry weather conditions.

H. Brown Coat
   1. Brown coat: allow scratch coat to dry minimum 24 hours and install stucco brown coat in accordance with applicable codes and manufacturer's requirements. Limit total thickness, including Sto ExtraSeal skim coat and scratch coat, stucco brown coat, and allowance for finish coat, to 5/8 inches (16 mm) maximum.

I. Crack Defense
   1. Apply base coat over the moist cured stucco brown coat with appropriate spray equipment or a stainless steel trowel to a uniform thickness of approximately ³ inch (3 mm). Work horizontally or vertically in strips of 40 inches (1016mm), and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2-½ inches (64 mm) at mesh seams and at overlaps of detail mesh. Feather seams and edges. Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re-skim with additional base
coat if mesh color is visible. Do not install base coat or mesh over joints or accessories in the stucco wall assembly.

J. Primer Installation
   1. StoPrime - Moist cure stucco brown coat for a minimum of 48 hours. Wait until stucco is 28 days old or the pH level of the surface is below 10 before applying primer. Age of stucco must be minimum 28 days before application of finish or pH must be below 10.

K. Finish Installation
   1. Apply finish to primed stucco and foam build-outs when dry. Apply finish by spraying or troweling with a stainless steel trowel, depending on the finish specified. Follow these general rules for application of finish:
      a. Allow 28 day stucco age or check for pH < 10 before applying finish. If StoPrime Hot is used, allow minimum 7 day age of stucco.
      b. Avoid application in direct sunlight.
      c. Apply finish in a continuous application, and work a wet edge towards the unfinished wall area. Work to an architectural break in the wall before stopping to avoid cold joints.
      d. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
      e. Float “R” (rilled or swirl texture) finishes with a plastic float to achieve their rilled texture
      f. Do not install separate batches of finish side-by-side.
      g. Do not apply finish into or over sealant joints or joint accessories. Apply finish to outside face of wall only.
      h. Do not apply finish over irregular, high pH, or unprepared surfaces, or surfaces not in compliance with the requirements of the project specifications.

3.04 FIELD QUALITY CONTROL
   A. Owner’s qualified testing agency or building envelope consultant shall perform inspections and tests.
   B. Inspections: air barrier materials are subject to inspection to verify compliance with requirements.
      2. Installation of primary air barrier material, accessory materials, and compatible auxiliary materials over structurally sound substrates and in conformance with architectural design details, contractor’s shop drawings, project mock-up, and manufacturer’s written installation instructions.
      3. Air barrier continuity and connections without gaps and holes at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.
   C. Tests: air barrier materials and assembly are subject to tests to verify compliance with performance requirements:
      1. Qualitative air leakage test: ASTM E 1186
      2. Quantitative air leakage test: ASTM E 779, ASTM E 783, and ASTM E 1827
      3. Adhesion test: ASTM D 4541
      4. Qualitative adhesion and compatibility testing: wet sealant manufacturer’s field quality control adhesion test
   D. Repair non-conforming substrates and air barrier material installation to conform with project requirements.
E. Take corrective action to repair and replace, or reinstall materials, seal openings, gaps, or other sources of air leakage to conform with project performance requirements.

3.05 PROTECTION
   A. Provide protection of installed materials from water infiltration into or behind them.
   B. Provide protection of installed materials from dust, dirt, salts, or other surface contamination, precipitation, and freezing.
   C. Provide protection of installed primer and finish from dust, dirt, salts, precipitation, freezing and continuous high humidity until fully dry.

3.06 CLEANING, REPAIR AND MAINTENANCE
   A. Clean and maintain the stucco finish for a fresh appearance and to prevent water entry into and behind the stucco. Repair cracks, impact damage, spalls or delamination promptly.
   B. Maintain adjacent components of construction such as sealants, joints in construction, windows, doors, and flashing, to prevent water entry into the wall assembly.
   C. Refer to Sto reStore Repair and Maintenance Guide (reStore Program <http://www.stocorp.com/index.php/en/2009071430/Services/restore/menu-id-114.html>) for detailed information on stucco restoration - cleaning, repairs, recoating, resurfacing and refinishing, or re-cladding.

END OF SECTION
SECTION 09 6519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 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. Division 14 sections for elevator information

1.02 REFERENCES

A. Armstrong Flooring Technical Manuals
   1. Armstrong Flooring Guaranteed Installation Systems manual, F-5061

B. ASTM International:
   2. ASTM F 1066 Standard Specification for Vinyl Composition Tile

C. National Fire Protection Association (NFPA):

D. Canadian Standards
   1. CAN/ULC-S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

1.03 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.

C. 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.

1.04 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer’s technical data, installation and maintenance instructions (latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061) for flooring and accessories.

B. Submit the manufacturer’s standard samples showing the required colors for flooring and applicable accessories.

C. If required, submit the manufacturer’s certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
D. 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

1.05 QUALITY ASSURANCE
   A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
   B. Select an installer who is competent in the installation of Armstrong resilient vinyl composition tile flooring.
      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.

1.06 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.

1.07 PROJECT CONDITIONS
   A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of 85°F (29°C) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°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 the Armstrong Flooring Guaranteed Installations Systems manual, F-5061 for a complete guide on project conditions.

1.08 LIMITED WARRANTY
   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: 5 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.
PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Resilient tile flooring, wall base, adhesives and accessories:
   2. Manufacturer must have a headquarters in the United States of America

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RESILIENT TILE FLOORING MATERIALS

A. Basis of Design: Provide Safety Zone™ Slip-Retardant Tile Flooring manufactured by Armstrong Flooring Inc.
   1. Description: Vinyl tile composed of polyvinyl chloride resin, plasticizers, fillers, pigment, and grit. Tile shall have a nominal 0.020 in. (0.51 mm) thick pattern layer containing proprietary slip-retardant grit.
   2. Tile shall meet size, thickness, indentation, impact, deflection, dimensional stability, resistance to chemicals, squareness, and resistance to heat requirements of ASTM F 1066 Standard Specification for Vinyl Composition Tile, Class 2, through pattern.
   3. Pattern and Color: in color selected from the range currently available from Armstrong Flooring, Inc.
   4. Size: 12 in. x 12 in.
   5. Thickness: 1/8"/0.125 in. (3.2mm)

2.03 PRODUCT SUBSTITUTION

A. Substitutions: No substitutions permitted because of the specific attributes listed in Section 2.02.

2.04 ADHESIVES

A. For Tile Installation System, Full Spread: Provide Armstrong S-S-750 Premium Floor Tile Adhesive under the tile.

2.05 ACCESSORIES

A. Provide transition/reducing strips tapered to meet abutting materials.
B. Provide threshold of thickness and width as shown on the drawings.
C. 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.
D. 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 - EXECUTION

3.01 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.

3.02 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 with regard to conditions existing at the time of installation.

3.03 PREPARATION

A. 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 manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

B. Wood subfloors: Armstrong resilient floors are recommended on suspended wood subfloors with a 1/4" underlayment (see product installation systems for exceptions) and a minimum of 18" 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.


C. 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.

3.04 INSTALLATION OF FLOORING

A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061. 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.

3.05 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 as long as 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.

3.06 CLEANING

A. Perform initial and on-going maintenance according to the latest edition of Armstrong Guaranteed Flooring Installation Systems manual, F-5061.
3.07 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. (See Finishing The Job in the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061.)

END OF SECTION
SECTION 09 9000 - PAINTING AND COATING

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Surface preparation.
   B. Field application of paints and other coatings.
   C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
      1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
      2. Elevator pit ladders.
      3. Exposed surfaces of steel lintels and ledge angles.
      4. Mechanical and Electrical:
         a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
         b. In finished areas, paint shop-primed items.
   D. Do Not Paint or Finish the Following Items:
      1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
      2. Items indicated to receive other finishes.
      3. Items indicated to remain unfinished.
      4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
      5. Floors, unless specifically so indicated.
      7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS
   A. Section 05 5000 - Metal Fabrications: Shop-primed items.
   B. Section 05 5100 - Metal Stairs: Shop-primed items.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide complete list of all products to be used, with the following information for each:
      1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
      2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
      3. Manufacturer's installation instructions.
   C. Samples: Submit three paper chip samples, 6x4 inch (____x____ mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.
   D. Manufacturer's Instructions: Indicate special surface preparation procedures.
   E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets.
(MSDS), care and cleaning instructions, touch-up procedures, repair of painted and coated surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE
   A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.06 MOCK-UP
   A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
   B. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
   B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
   C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS
   A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
   B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
   C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
   D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
   E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
   B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
      1. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by CMH Architects, Inc. is obtained using the specified procedures for substitutions.
   C. Paints:
   D. Primer Sealers: Same manufacturer as top coats.
   E. Block Fillers: Same manufacturer as top coats.
2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and
      uniformly dispersed to a homogeneous coating, with good flow and brushing properties,
      and capable of drying or curing free of streaks or sags.
   2. Supply each coating material in quantity required to complete entire project's work from a
      single production run.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure
      is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top
   coats; where the manufacturer offers options on primers for a particular substrate, use primer
categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the
      following:
      a. 40 CFR 59, Subpart D—National Volatile Organic Compound Emission Standards for
         Architectural Coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59,
      Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added
      at project site; or other method acceptable to authorities having jurisdiction.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected
   later by CMH Architects, Inc. from the manufacturer's full line.

E. Colors: As indicated on drawings
   1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the
      wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Masonry - Concrete Block CMU: (Painted) One Acrylic Latex Filler Coat & Two Acrylic Finish
   Coats
   1. Filler:
      a. BM 206 Super Spec Acrylic Latex Block Filler (45 g/L)
      b. PPG 6-12 Speedhide Acrylic Latex Masonry Block Filler
      c. S/W B25W25 PrepRite Interior / Exterior Latex Block Filler (42 g/l)
   2. Finish:
      a. 184 Super Spec 100% Acrylic Low Lustre House Paint (149 g/L)
      b. PPG 76 line Sunproof Acrylic Latex Satin House Paint
      c. S/W A-82 A100 Exterior Acrylic Satin House Paint (109 g/l)

B. Masonry - Concrete Block, CMU: (Textured Coating) One Acrylic Latex Filler Coat & Two
   Acrylic Finish Coats
   1. Filler:
      a. BM 206 Super Spec Acrylic Latex Block Filler (45 g/L)
      b. PPG 6-12 Speedhide Acrylic Latex Masonry Block Filler
      c. S/W B25W25 PrepRite Interior / Exterior Latex Block Filler 42 g/l)
   2. Finish:
      a.
      b.

C. Concrete – Poured, Pre-cast & Stucco: (Painted) One Acrylic Primer Coat & Two Acrylic
   Finish Coats
   1. Primer:
      a. BM N068 Super Spec Acrylic Masonry Primer (97 g/L)
      b. PPG 17-21 Seal Grip Acrylic Stain Blocking Primer
PAINTING AND COATING

D. Concrete - Poured, Pre-cast & Stucco: (Textured Coating) One Prime Coat & Two Finish Coats.
   1. Primer:
      a. BM  N068  Super Spec Acrylic Masonry Primer (97 g/L)
      b. PPG  6-603 Speedhide Alkali Resistant Acrylic Primer
      c. S/W  A24-300 Series Loxon Acrylic Masonry Primer (130 g/l)
      d. (S/W option) A24-100 Loxon Acrylic Masonry Conditioner (White 109 g/l) (Clear 129 g/l)
   2. Finish:
      a. BM  3192 Coronado Texcrete Acrylic Latex Sand Texture Coating (100g/L)
      b. 3196 Coronado Texcrete Acrylic Latex Medium Texture Coating (100g/L)
      c. 4-50 Speedhide Smooth Texture Coating
      e. 4-60 Speedhide Course Texture Coating
      f. S/W  A44W801 UltraCrete Fine Texture 100% Acrylic (55 g/l)
      g. A44W811 UltraCrete Medium Texture 100% Acrylic (55 g/l)
      h. A44W821 UltraCrete 100% Acrylic Coarse Texture Coating (55 g/l)

E. Ferrous Metals (misc.): One Alkyd Primer Coat & Two Alkyd Finish Coats
   1. Primer:
      a. BM  P-06 Super Spec HP Alkyd Metal Primer (323 g/L)
      b. PPG  6-208 Speedhide Alkyd Rust Inhibitive Primer
      c. S/W  B50Z Kem Kromik Universal Alkyd Primer (405 g/l)
   2. Finish:
      a. BM  V200 Corotech Alkyd Urethane Gloss Enamel (340 g/L)
      b. PPG  6-284 Speedhide Alkyd Gloss Enamel
      c. S/W  B54Z Industrial Alkyd Gloss Enamel (440 g/l)

F. Galvanized Metal: One Prime Coat & Two Alkyd Finish Coats
   1. Primer:
      a. BM  P04 Super Spec HP Acrylic Metal Primer (54 g/L)
      b. PPG  209 Speedhide Galvanized Metal Primer
      c. S/W  B50W3 Galvite Galvanized Metal Primer (312 g/l)
   2. Finish:
      a. P24 Super Spec HP Alkyd DTM Semi-Gloss Enamel (419 g/L)
      b. PPG  6-284 Speedhide Alkyd Gloss Enamel
      c. S/W  B54Z Industrial Alkyd Gloss Enamel (440 g/l)

G. Gypsum Drywall: One Acrylic Primer Coat & Two 100% Acrylic Finish Coats
   1. Primer:
PAINTING AND COATING

2.04 PAINT SYSTEMS - INTERIOR

A. Masonry - Concrete Block: One Acrylic Latex Filler Coat & Two Acrylic Latex Finish

1. Filler:
   a. BM 169 Super Spec Acrylic Latex Primer (83 g/L)
   b. PPG 6-603 Speedhide Acrylic Latex Primer
   c. S/W B42W8041 Exterior Latex Primer (87 g/l)

2. Finish:
   a. 184 Super Spec 100% Acrylic Low Lustre House Paint (149 g/L)
   b. 6-610 Speedhide Exterior Acrylic Latex Flat House Paint
   c. 6-2045 Speedhide Exterior Acrylic Latex Satin House Paint
   d. 6-900 Speedhide Exterior Acrylic Latex Semi-Gloss House & Trim Paint
   e. A-6 Series, A100 Exterior Acrylic Flat House Paint (146 g/l)
   f. A-82 Series, A100 Exterior Acrylic Satin House Paint (109 g/l)
   g. A-8 Series, A100 Exterior Acrylic Gloss House & Trim Paint (134 g/l)

B. Ferrous Metals: One Alkyd (oil base) Primer Coat & Two Alkyd Gloss Finish Coats

1. Primer:
   a. BM P-06 Super Spec HP Alkyd Metal Primer (323 g/L)
   b. PPG 6-212 Speedhide Alkyd Rust Inhibiting Metal Primer
   c. S/W B50Z Kem Kromik Universal Metal Primer (405 g/l)

2. Finish:
   a. BM V200 Corotech Alkyd Urethane Gloss Enamel (340 g/L)
   b. PPG 6-284 Speedhide Alkyd Gloss Enamel
   c. S/W B54Z Industrial Alkyd Gloss Enamel (440 g/l)

C. Galvanized Metal: One Water Base Prime Coat & Two Alkyd Finish Coats

1. Primer:
   a. BM P04 Super Spec HP Acrylic Metal Primer (54 g/L)
   b. PPG 6-209 Speedhide Galvanized Metal Primer
   c. S/W B50W3 Galvite Galvanized Metal Primer (312 g/l)

2. Finish:
   a. BM 792 Advance Waterborne Alkyd Satin Enamel (48 g/L)
   b. PPG 6-90 Speedhide Alkyd Eggshell Enamel
   c. S/W B33W8251 ProMar 200 Interior Waterbased Acrylic-Alkyd EggShell (<100 g/l)

D. Gypsum Drywall: One Acrylic Latex Primer & Two Acrylic Latex Finish Coats

1. Primer:
   a. BM N534 Ultra Spec 500 Acrylic Latex Zero VOC Primer (0 g/L)
   b. PPG 9-2 Pure Performance Latex Interior Zero VOC Primer
   c. S/W B28W2600 ProMar 200 Zero VOC Interior Latex Primer (0 g/l)

2. Finish:
   a. BM N538 Ultra Spec 500 Acrylic Latex Zero VOC Eggshell Enamel (0 g/L)
   b. PPG 9-411 Pure Performance Eggshell Enamel
   c. S/W B20W2600 ProMar 200 Zero VOC Latex Eggshell Enamel (0 g/l)
2.05 ACCESSORY MATERIALS
   A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
   B. Patching Material: Latex filler.
   C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Do not begin application of coatings until substrates have been properly prepared.
   B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
   C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
   D. If substrate preparation is the responsibility of another installer, notify CMH Architects, Inc. of unsatisfactory preparation before proceeding.
   E. Test shop-applied primer for compatibility with subsequent cover materials.
   F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
      1. Plaster and Stucco: 12 percent.
      2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION
   A. Clean surfaces thoroughly and correct defects prior to coating application.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
   D. Seal surfaces that might cause bleed through or staining of topcoat.
   E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
   F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
   G. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
   H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
   I. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
   J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION
A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Apply products in accordance with manufacturer's instructions.
C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
E. Apply each coat to uniform appearance.
F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
G. Sand wood and metal surfaces lightly between coats to achieve required finish.
H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL
A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING
A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION
A. Protect finished coatings until completion of project.
B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION
SECTION 10 1400 - SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowance for signs.
B. Design, fabrication and installation of all signs shown in the signage package issued as part of the contract drawings.

1.02 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through CMH Architects, Inc. at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through CMH Architects, Inc. prior to fabrication.
D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.
C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
B. Maintain this minimum temperature during and after installation of signs.
PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Manufacturer's meeting Quality Assurance requirements in Part One.

2.02 SIGNAGE APPLICATIONS
   A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

2.03 ACCESSORIES
   A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
   B. Exposed Screws: Stainless steel.
   C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install neatly, with horizontal edges level.
   C. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION
SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Fire extinguishers.
   B. Accessories.

1.02 RELATED REQUIREMENTS
   A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
   B. Section 09 9000 - Painting

1.03 REFERENCE STANDARDS
   C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
   C. Product Data: Provide extinguisher operational features.
   D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
   E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS
   A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Fire Extinguishers:
         a. Water Type: Grenadier Series
         b. Dry Chemical Type: Cosmic or Galaxy Series
         c. Carbon Dioxide Type: Sentinel Series
      2. Other Acceptable Manufacturers:
         e. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS
   A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
      1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
   B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
      2. Finish: Baked polyester powder coat, red color.
      3. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to ___ degrees F (___ degrees C).
2.03 ACCESSORIES
   A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.

3.02 INSTALLATION
   A. Install in accordance with manufacturer’s instructions.
   B. Secure rigidly in place.
   C. Place extinguishers in cabinets.

END OF SECTION
SECTION 14 2100 - GENERAL

SUMMARY

1.01 SECTION INCLUDES: ELECTRIC TRACTION ELEVATORS.

A. Products Supplied But Not Installed Under this Section:
   1. Hoist Beam
   2. Pit Ladder
   3. Inserts mounted in block walls for rail attachments

B. Work Supplied Under Other Sections:
   1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
   2. Main line disconnects for each elevator.
      a. One fused three phase permanent power in building electrical distribution room
   3. Hoistway ventilation shall be in accordance with local and national building code requirements.
   4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
   5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
   6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
   7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
   8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.
   9. Access Doors: As required for access to governor. Access door shall be self-closing, self-locking if necessary and operable from the inside without a key.

C. Related sections:
   1. Section 015000 - Temporary Facilities and Controls
   2. Section 042000 - Unit Masonry
   3. Section 230000 - Heating, Ventilating, and Air Conditioning
   4. Section 260000 - Electrical
   5. Section 263000 - Electric Power Generating and Storing Equipment
   6. Section 283100 - Fire Detection and Alarm
   7. Section 310000 - Earthwork

D. Industry and government standards:
   1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
   2. ADAAG - Accessibility Guidelines for Buildings and Facilities
   3. ANSI/NFPA 70, National Electrical Code
   4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows

1.02 DESCRIPTION OF ELEVATOR

A. Elevator Equipment: KONE EcoSpace™ gearless traction elevator
B. Equipment Control: KCM831
C. Drive: Non Regenerative
D. Quantity of Elevators: 1
E. Landings: 2
F. Openings: 2
   1. Front Openings, 2
   2. Back Openings, 0

G. Travel: 12'-0"

H. Rated Capacity: 3500 lbs

I. Rated Speed: 150 fpm

J. Clear Inside Dimensions: 6'-8" x 5'-6 3/8"

K. Cab Height: 8' 0"

L. Clear height under suspended ceiling: min 13'-0"

M. Entrance Width and Type: 3'0" and (Left)

N. Entrance Height: 7' 0"

O. Main Power Supply: 208 Volts + 5%, three-phase

P. Operation: Simplex

Q. Machine Location: Inside the hoistway mounted on car guide rail

R. Control Space Location: Adjacent room upper landing

S. Elevator Equipment shall conform to the requirements of seismic zone: non-seismic

T. Maintenance Service Period: 12 months

1.03 PERFORMANCE REQUIREMENTS

A. Car Performance
   1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
   2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance
   1. Vertical Vibration (maximum): 25 mg
   2. Horizontal Vibration (maximum): 25 mg
   3. Jerk Rate (maximum): 3.3 ft/sec³
   4. Acceleration (maximum) 1.3 ft/sec²
   5. In Car Noise: = 55 dB(A)
   6. Leveling Accuracy: ±0.2 inches
   7. Starts per hour (maximum): 120

1.04 SUBMITTALS

A. Comply with Section 01 3000 - Submittal Procedures.

B. Product Data: Submit manufacturer's product literature for each proposed system.
   1. Cab design, dimensions and layout.
   2. Layout, finishes, and accessories and available options.
   3. Controls, signals and operating system.

C. Shop Drawings:
   1. Clearances and travel of car.
   2. Clear inside hoistway and pit dimensions.
   3. Location and layout of equipment and signals.
   4. Car, guide rails, buffers and other components in hoistway.
   5. Maximum rail bracket spacing.
   7. Hoist beam requirements.
   8. Location and sizes of access doors.
9. Location and details of hoistway door and frames.
10. Electrical characteristics and connection requirements.

D. Operation and maintenance data:
   1. Provide manufacturer's standard maintenance and operation manual.

E. Diagnostic Tools
   1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks 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 completed project. During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and installed by the Elevator Contractor. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

1.05 QUALITY ASSURANCE
   A. Manufacturer: Minimum of fifteen years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.
   B. Installer: The equipment manufacturer shall install the elevator.
   C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.06 DELIVERY, STORAGE AND HANDLING
   A. Comply with manufacturer’s recommendations for delivery, storage and handling.
   B. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.
   C. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.07 WARRANTY
   A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and
workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.08 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service be performed during regular working hours of regular working days and shall include regular time call back service.

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PRODUCTS

2.01 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:


B. Other Acceptable Manufacturers - Electric Traction Elevators:


C. Other acceptable machine room-less products: manufacturer with minimum 15 years experience in manufacturing, installing, and servicing elevators of the type required for the project.

2.02 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer based control system to perform all of the functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.

2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.

3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.

4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Locate controllers in a room adjacent to the hoistway at the top landing on the machine side of the elevator.

2.03 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer.

D. Hoistway Operating Devices:
1. Emergency stop switch in the pit
2. Terminal stopping switches.
3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.
F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.04 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances
   2. Doors: Hollow metal construction with vertical internal channel reinforcements.
   3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
   4. Entrance Finish: Brushed Stainless SteelCol.
   5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambbs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.05 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.
B. Platform: Platform shall be all steel construction.
C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.
D. Steel Cab Finish: Color Laminate Series
   1. Car Wall Panels: Non-removable vertical panels plastic laminate selected from standard manufacturer's catalog of choices.
   2. Skirting: MonoSpace EcoSystem MR Stainless Steel with Satin Finish
   5. Ceiling:
      a. Fluorescent Drop Ceiling - LF-94: Satin Finished Stainless Steel three panel suspended ceiling with one slot on each of the outer panels for T-5 Fluorescent lights.
   6. Handrail: 1.5" round in Stainless Steel with Satin Finish
      a. side and back wall of car enclosure.
   7. Flooring: By others. (Not to exceed 2sqft and 1/2" finished depth.)
   8. Threshold: Aluminum
E. Emergency Car Signals
   1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
   2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
   3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.
   4. Ventilation: Fan

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide vandal resistant car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be: Textured Stainless Steel.
1. Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have white illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be white DOT-matrix. All texts, when illuminated, shall be white. The car operating panel shall have a brushed stainless steel finish.

2. Additional features of car operating panel shall include:
   a. Car Position Indicator within operating panel white.
   b. Elevator Data Plate marked with elevator capacity and car number on car top.
   c. Help buttons with raised markings.
   d. In car stop switch per local code.
   e. Firefighter's hat.
   f. Firefighter's Phase II Key-switch.
   g. Call Cancel Button.
   h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)
   i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

B. Hall Fixtures: Wall mounted vandal resistant hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a brushed stainless steel finish. Configuration to be KSS-140
   1. Vandal Resistant Hall fixtures shall feature round, mechanical, illuminated buttons in flush fixture housings. Hall fixtures shall correspond to options available from that landing.

C. Car Lantern and Chime: A vandal resistant directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Scottish Quad Textured Steel finish.

D. Hall Lanterns and Chime: A vandal resistant directional lantern visible from the corridor shall be provided at each hall entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Scottish Quad Textured Steel finish.

2.07 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation
   1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
   2. Zoned Car Parking.

B. Standard Operating Features to include:
   1. Full Collective Operation
   2. Fan and Light Control
   3. Load Weighing Bypass
   4. Ascending Car Uncontrolled Movement Protection
   5. Top of Car Inspection Station
C. Additional Operating Features to include:
   1. Emergency Battery Power Supply
      a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if used) will be provided by others.

D. Elevator Control System for Inspections and Emergency
   1. Provide devices within controller to run the elevator in inspection operation.
   2. Provide devices on car top to run the elevator in inspection operation.
   3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
   4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
   5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
   6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
   7. Provide the means for the control to reset elevator earthquake operation.

2.08 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

EXECUTION

3.01 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.
B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of Work, verify projections greater then 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less then 75 degrees from horizontal.

E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION
A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.03 INSTALLATION
A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer’s recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to substantial completion.

3.04 CONSTRUCTION
A. Interface with Other Work:
   1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
   2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
      a. Ensure adequate support for entrance attachment points at all landings.
      b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
      c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
      d. Coordinate interface of elevators and fire alarm system.
      e. Coordinate interface of dedicated telephone line.

3.05 TESTING AND INSPECTIONS
A. Perform recommended and required testing in accordance with authority having jurisdiction.

B. Obtain required permits and provide originals to Owner’s Representative.
3.06 DEMONSTRATION

A. Prior to substantial completion, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION
SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Building wires and cables rated 600 V and less.
      2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES
   A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
   B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and Type XHHW-2.

2.2 CONNECTORS AND SPLICES
   A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION
   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. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS
   A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
   B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
   A. Service Entrance: Type XHHW-2, single conductors in raceway.
   B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
   C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
   D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
   E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
   F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
   G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
3.3 INSTALLATION OF CONDUCTORS AND CABLES
   A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
   B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
   C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
   D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
   E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
   F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS
   A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
   B. Make splices, terminations, and taps that are compatible with conductor material.
   C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION
   A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
   B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
   A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING
   A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL
   A. Perform the following tests and inspections:
      1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   B. Test and Inspection Reports: Prepare a written report to record the following:
      1. Procedures used.
      2. Results that comply with requirements.
      3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
   C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION
SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION
   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. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS
   A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
   B. Bare Copper Conductors:
      4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
      5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
      6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
      7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS
   A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
   B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
   C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
   D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES
   A. Ground Rods: Copper-clad steel; 5/8 by 96 inches (16 by 2400 mm).

PART 3 - EXECUTION

3.1 APPLICATIONS
   A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches (600 mm) below grade.

C. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 GROUNDING AT THE SERVICE
A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING
A. Install insulated equipment grounding conductors with all feeders and branch circuits.
B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION
A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.5 FIELD QUALITY CONTROL
   A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION
SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes:
      1. Hangers and supports for electrical equipment and systems.
      2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS
   A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 QUALITY ASSURANCE
   A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
   A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
      1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
      2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
      3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
      4. Channel Dimensions: Selected for applicable load criteria.
   B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
   C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
   D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
   E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
      1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES
A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION
A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION
A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
   6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
3.3 INSTALLATION OF FABRICATED METAL SUPPORTS
   A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
   B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES
   A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
   B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.
   C. Anchor equipment to concrete base.
      1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
      2. Install anchor bolts to elevations required for proper attachment to supported equipment.
      3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING
   A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
      1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
   B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Surface raceways.
   5. Boxes, enclosures, and cabinets.
   6. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: Setscrew.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
   4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ENT: Comply with NEMA TC 13 and UL 1653.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.
E. Continuous HDPE: Comply with UL 651B.
F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
H. Fittings for LFNC: Comply with UL 514B.
I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
J. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services’ “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS
A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 SURFACE RACEWAYS
A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.
C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.5 BOXES, ENCLOSURES, AND CABINETS
A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
E. Metal Floor Boxes:
1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

K. Gangable boxes are allowed.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:
   1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
   1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
   2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
   1. Standard: Comply with SCTE 77.
   2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded lettering, "ELECTRIC.".
   6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: IMC.
   2. Concealed Conduit, Aboveground: IMC.
   3. Underground Conduit: RNC, Type EPC-80-PVC.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: IMC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.
D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
   4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
F. Install surface raceways only where indicated on Drawings.
G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 2 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to IMC before rising above floor.

I. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer’s written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer’s written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV.3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Support boxes of three gangs or more from one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.

2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.

3. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.

b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."
3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES
   A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
   B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
   C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
   D. Install handholes with bottom below frost line, below grade.
   E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
   A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING
   A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION
   A. Protect coatings, finishes, and cabinets from damage and deterioration.
      1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
      2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION
SECTION 26 0544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
5. Silicone sealants.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES
A. Wall Sleeves:
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
C. Sleeves for Rectangular Openings:
2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS
A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS
A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
2.4 GROUT
A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS
A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS
A. Comply with NECA 1.
B. Comply with NEMA VE 2 for cable tray and cable penetrations.
C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.
3.2 SLEEVE-SEAL-SYSTEM INSTALLATION
A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION
A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
C. Secure nailing flanges to concrete forms.
D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION
SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Equipment identification labels.
   8. Miscellaneous identification products.

1.2 QUALITY ASSURANCE
A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.
C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
E. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
   2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS
A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
   2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 FLOOR MARKING TAPE
A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE
A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
   3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.6 WARNING LABELS AND SIGNS
B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:
   1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.
   3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
PART 3 - EXECUTION

3.1 INSTALLATION
   A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
   B. Apply identification devices to surfaces that require finish after completing finish work.
   C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
   D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
   E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
   F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
   G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE
   A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot (3-m) maximum intervals.
   B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
      1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service and feeder conductors.
         a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
         b. Colors for 208/120-V Circuits:
            1) Phase A: Black.
            2) Phase B: Red.
            3) Phase C: Blue.
         c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
   C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
   D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
      1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.


F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION
SECTION 26 0573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY AND ARC
FLASH HAZARD STUDY

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes computer-based, fault-current and overcurrent protective device
coordination studies, and ARC flash studies. Protective devices shall be set based on results of
the protective device coordination study.

1.3 ACTION SUBMITTALS
A. Product Data: For computer software program to be used for studies.
B. Other Action Submittals: The following submittals shall be made after the approval process for
system protective devices has been completed. Submittals shall be in digital form.
1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
4. ARC Flash Hazard Report

1.4 INFORMATIONAL SUBMITTALS
A. Product Certificates: For coordination-study, fault-current-study, ARC Flash Hazard computer
software programs, certifying compliance with IEEE 399 and 1584.

1.5 QUALITY ASSURANCE
A. Studies shall use computer programs that are distributed nationally and are in wide use.
Software algorithms shall comply with requirements of standards and guides specified in this
Section. Manual calculations are not acceptable.
B. Study Specialist Qualifications: An entity experienced in the application of computer software
used for studies, having performed successful studies of similar magnitude on electrical
distribution systems using similar devices.
1. Professional engineer, licensed in the state where Project is located, shall be responsible
for the study. All elements of the study shall be performed under the direct supervision
and control of engineer.
C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
D. Comply with IEEE 399 for general study procedures.
E. Comply with IEEE 1584 for Arc-Flash hazard calculations.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS
A. Computer Software Developers: Subject to compliance with requirements, provide products by
one of the following:
1. SKM Systems Analysis, Inc.
2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399 and 1584.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:
   a. Arcing faults.
   b. Simultaneous faults.
   c. Explicit negative sequence.
   d. Mutual coupling in zero sequence.

D. Computer software program shall be capable of determining: bolted fault currents, arc fault currents, protective device characteristics, duration of arcs, incident energy for all equipment, flash-boundary of all equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other electrical Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2. Impedance of utility service entrance.

3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
   a. Circuit-breaker and fuse-current ratings and types.
   b. Relays and associated power and current transformer ratings and ratios.
   c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
   d. Generator kilovolt amperes, size, voltage, and source impedance.
   e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
   f. Busway ampacity and impedance.
   g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
a. Special load considerations, including starting inrush currents and frequent starting and stopping.
b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company’s overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY
A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
   1. Switchboard bus.
   2. Distribution panelboard.
B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.
   1. Transformers:
      a. ANSI C57.12.10.
      b. ANSI C57.12.22.
      c. ANSI C57.12.40.
      d. IEEE C57.12.00.
      e. IEEE C57.96.
E. Calculate Arc-Flash hazards per IEEE 1584.
F. Study Report:
   1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
G. Equipment Evaluation Report:
1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.

3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY


1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.

2. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 241 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:
   a. Inrush current when first energized.
   b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
   c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
   a. Device tag.
   b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
   c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
   d. Fuse-current rating and type.
   e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
   a. Device tag.
   b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

G. Completed data sheets for setting of overcurrent protective devices.

3.5 Arc Flash Study Report

A. Tabular format showing the following:
   1. Bus Name
   2. Protective Device Name
   3. Bus kV
   4. Bus Bolted Fault (kA)
   5. Bus Arcing Fault (kA)
   6. Protective Device Bolted Fault (kA)
   7. Protective Device Arcing Fault (kA)
   8. Trip/Delay Time
   9. Breaker Opening Time
  10. Ground
  11. Equipment Type
  12. Gap (mm)
  13. Arc Flash Boundary (in)
  14. Working Distance (in)
  15. Incident Energy (cal/cm²)
  16. PPE Level

B. Provide labels for all equipment Per NEC 70E, NEC 70, OSHA, and IEEE 1584.

END OF SECTION
SECTION 26 2200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
      1. Distribution transformers.

1.2 ACTION SUBMITTALS
   A. Product Data: For each product indicated.
   B. Shop Drawings: Indicate dimensions and weights.

1.3 CLOSEOUT SUBMITTALS
   A. Operation and maintenance data.

1.4 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

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:
   B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      2. Siemens
      3. Square D
      4. Eaton: Cutler Hammer

2.2 GENERAL TRANSFORMER REQUIREMENTS
   A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
   B. Cores: Grain-oriented, non-aging silicon steel.
   C. Coils: Continuous windings without splices except for taps.
      1. Internal Coil Connections: Brazed or pressure type.
      2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS
   A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
   B. Cores: One leg per phase.
   C. Enclosure: Ventilated, NEMA 250, Type 2.
      1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
   D. Transformer Enclosure Finish: Comply with NEMA 250.
      1. Finish Color: Gray.
E. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
I. Energy Efficiency for Transformers Rated 15 kVA and Larger:
   1. Complying with NEMA TP 1, Class 1 efficiency levels.
   2. Tested according to NEMA TP 2.
J. Wall Brackets: Manufacturer's standard brackets.

2.4 IDENTIFICATION DEVICES
A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Section 260553 "Electrical Identification."

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

3.2 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3.3 ADJUSTING
A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

END OF SECTION
SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS
A. Operation and maintenance data.

1.4 QUALITY ASSURANCE
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. Comply with NEMA PB 1.
C. Comply with NFPA 70.

1.5 WARRANTY
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS
A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.
B. Enclosures: As indicated on drawings.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
C. Incoming Mains Location: As indicated on drawings. Coordinate in field.
D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
E. Conductor Connectors: Suitable for use with conductor material and sizes.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.


2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   2. Siemens
   3. Square D
   4. Eaton: Cutler Hammer


C. Doors: Secured with vault-type latch and tumbler lock; keyed alike. Concealed hinge.

D. Mains: As indicated on the drawings.


F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As indicated on the drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Same as panelboard.
B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.
   4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
   5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
   8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.
      b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
      c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
      d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
      e. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
      g. Handle Clamp: Loose attachment for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.
   B. Comply with mounting and anchoring requirements.
   C. Mount top of trim no more than 90 inches (2286 mm) above finished floor unless otherwise indicated.
   D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
   E. Install overcurrent protective devices and controllers not already factory installed.
      1. Set field-adjustable, circuit-breaker trip ranges.
   F. Install filler plates in unused spaces.
   G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
I. Comply with NECA 1.

3.2 IDENTIFICATION
A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Electrical Identification."
B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Electrical Identification."
D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Electrical Identification."

3.3 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
D. Panelboards will be considered defective if they do not pass tests and inspections.
E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION
SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Receptacles, receptacles with integral GFCI, and associated device plates.
      2. Weather-resistant receptacles.
      3. Snap switches and wall-box dimmers.
      4. Wall-switch and exterior occupancy sensors.

1.2 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS
   A. Product Data: For dimmer switches.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Manufacturers’ Names: Shortened versions (shown in parentheses) of the following manufacturers’ names are used in other Part 2 articles:
      1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

   B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS
   A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

   B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES
   A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 GFCI RECEPTACLES
   A. General Description:
      1. Straight blade, feed-through type.
      2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
      3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

   B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

2.5 TOGGLE SWITCHES
   A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
   B. Switches, 120/277 V, 20 A:
   C. Key-Operated Switches, 120/277 V, 20 A:
      1. Description: Single pole, with factory-supplied key in lieu of switch handle.
2.6 WALL-BOX DIMMERS
   A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
   B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472. Coordinate type with lamp type.

2.7 WALL PLATES
   A. Single and combination types shall match corresponding wiring devices.
      1. Plate-Securing Screws: Metal with head color to match plate finish.
      2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
      4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
   B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.8 FINISHES
   A. Device Color:
      1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
   B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
   B. Coordination with Other Trades:
      1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
      2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
      3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
      4. Install wiring devices after all wall preparation, including painting, is complete.
   C. Conductors:
      1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
      2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
      3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
      4. Existing Conductors:
         a. Cut back and pigtail, or replace all damaged conductors.
         b. Straighten conductors that remain and remove corrosion and foreign matter.
         c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
   D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers’ device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES
A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL
A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

END OF SECTION
SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Enclosures.

1.2 DEFINITIONS
A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

1.4 CLOSEOUT SUBMITTALS
A. Operation and maintenance data.

1.5 QUALITY ASSURANCE
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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NONFUSIBLE SWITCHES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   4. Square D; a brand of Schneider Electric.
B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   4. Lugs: Suitable for number, size, and conductor material.
   5. Service-Rated Switches: Labeled for use as service equipment.
2.2 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   3. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Section 260553 “Electrical Identification.”
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION
SECTION 26 5119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes the following types of LED luminaires:
      2. Downlight.
      3. Linear industrial.
      5. Surface mount, nonlinear.

1.3 DEFINITIONS
   A. CCT: Correlated color temperature.
   B. CRI: Color Rendering Index.
   C. Fixture: See "Luminaire."
   D. IP: International Protection or Ingress Protection Rating.
   E. LED: Light-emitting diode.
   F. Lumen: Measured output of lamp and luminaire, or both.
   G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. See lighting fixture schedule on plans.
   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.
   C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For testing laboratory providing photometric data for luminaires.
B. Product Certificates: For each type of luminaire.

C. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers’ codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 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. Provide luminaires from a single manufacturer for each luminaire type.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 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.

B. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).

1. Relative Humidity: Zero to 95 percent.

C. Altitude: Sea level to 1000 feet (300 m).
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.

2.3 MATERIALS

A. 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.

B. Steel:
   1. ASTM A 36/A 36M for carbon structural steel.
   2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:
   1. Manufacturer’s standard grade.
   2. Manufacturer’s standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

2.4 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.
2.5 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 A 641/A 641 M, 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 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 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.

E. Flush-Mounted Luminaires:
   1. Secured to outlet box.
   2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
   3. Trim ring flush with finished surface.
F. Wall-Mounted Luminaires:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:
   1. Ceiling Mount:
      a. Two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 10 feet (3 m) in length.
      b. Four-point pendant mount with 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 10 feet (3 m) in length.
      c. Hook mount.
   2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
   4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
   5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:
   1. Secure to any required outlet box.
   2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION
   A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 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.
3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION
SECTION 265619 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.
B. CRI: Color rendering index.
C. Fixture: See "Luminaire."
D. IP: International Protection or Ingress Protection Rating.
E. Lumen: Measured output of lamp and luminaire, or both.
F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.

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.

C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of the following:
   1. Luminaire.
   2. Photoelectric relay.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers’ codes.
   2. Provide a list of all photoelectric relay types used on Project; use manufacturers’ codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers’ laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.
1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures, including luminaire support components.
   b. Faulty operation of luminaires and accessories.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 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.

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. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. Lamp base complying with ANSI C81.61 or IEC 60061-1.

E. Bulb shape complying with ANSI C79.1.

F. CRI of minimum 70.

G. L70 lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Internal driver.

J. Nominal Operating Voltage: 277 V ac.

K. In-line Fusing: Separate in-line fuse for each luminaire.

L. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
M. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

A. See fixture schedule on plans.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located 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 for all luminaires.
2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
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.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

1. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.6 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.
C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

   a. IES LM-5.
   b. IES LM-50.
   c. IES LM-52.
   d. IES LM-64.
   e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.9 DEMONSTRATION

A. Train Owner’s maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.10 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer’s authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION
SECTION 32 3913 - DECORATIVE METAL BOLLARDS

PART 1 GENERAL

1.01 SUMMARY
   A. Section Includes:
      1. Decorative metal bollards.
      2. Accessories

1.02 REFERENCE STANDARDS
   C. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

1.03 SUBMITTALS
   A. Comply with Section 01 3000 – for Submittal Procedures.
   B. Product Data: Provide for each type of bollard, component, finish, and accessory specified.
   C. Color Samples: Submit manufacturer’s standard colors for selection
   D. Setting Drawings: Show embedded items and cutouts required for work specified in other Sections.
   E. Maintenance Data: Submit manufacturer’s field touch-up, cleaning, and maintenance instructions.
   F. Warranty Documentation: Submit sample of manufacturer’s warranty.

1.04 QUALITY ASSURANCE
   A. Comply with Section 01 4000 – Quality Assurance.

1.05 DELIVERY, STORAGE AND HANDLING
   A. Comply with Section 01 6000 – Product Requirements.
   B. Protect bollards and accessories during delivery, storage, and handling.

1.06 WARRANTY
   A. Provide manufacturer’s standard warranty against defects in materials and workmanship.
      1. Warranty Period: Five years from date of invoice, except as otherwise indicated.
      2. Coatings: Two years, against peeling, cracking, or significant color change.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturer: Reliance Foundry Co. Ltd.
      1. Phone: 604-592-4333 or 888-735-5680
      2. Fax: 604-590-8875
      3. Website: <http://www.reliance-foundry.com/bollard>
      4. Email: info@reliance-foundry.com <mailto:info@reliance-foundry.com>
   B. Substitutions: Comply with provisions of Division 1
   C. METAL BOLLARDS
D. Bollard:
   1. Model: Reliance Foundry; R-7576.
   2. Height: 34.25 inches (87 cm)
   3. Diameter: 5.75 inches (14.6 cm) body; 5.75 inches (14.6 cm) base
   4. Weight: 51 lbs. (23.1 kg)
   5. Design: Cylindrical with round finial and rounded top.
   8. Color Coating:
      a. Type: Polyester powder coat over epoxy primer.
      b. Color: Black textured semi gloss
         1) Installation:
      c. Removable, existing concrete, insert.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Examine paving or other substrates for compliance with manufacturer’s requirements for placement and location of embedded items, condition of substrate, and other conditions affecting installation of bollards.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
   A. General: Comply with manufacturer’s installation instructions and setting drawings.
   B. Do not install damaged, cracked, chipped, deformed or marred bollards. Field touch-up minor imperfections in accordance with manufacturer’s instructions. Replace bollards that cannot be field repaired.

3.03 CLEANING & PROTECTION
   A. <http://www.reliance-foundry.com/bollard/maintenance-bollards>Protect bollards against damage.
   B. Immediately prior to Substantial Completion, clean bollards in accordance with manufacturer’s instructions to remove dust, dirt, adhesives, and other foreign materials.
   C. Touch up damaged finishes according to manufacturer’s instructions.

3.04 CLOSEOUT ACTIVITIES
   A. Provide executed warranty.

END OF SECTION